

<p style="text-align: center;">APPENDIX H SUPPORTING INFORMATION FOR WATERSHED AND AQUATIC RESOURCES ANALYSIS</p>

ANALYSIS METHODS

EQUIVALENT CLEARCUT AREA

The ECA model procedures are derived from Forest Hydrology, Part II (USDA Forest Service, 1974). Equivalent Clearcut Area (ECA) analysis is a tool used to index the relationship between vegetation condition and water yield from forested watersheds. The basic assumptions of the procedure are that removal of forest vegetation results in water yield increases and that ECA can be used as an index of these increases. Depending on the interaction between water yield, sediment yield, and stream channel conditions, such increases could have impacts on stream channels.

Water yield increases can be directly modeled, but equivalent clearcut area is often used as a surrogate. The ECA model is designed to estimate changes in mean annual streamflow resulting from forest practices or treatments (roading, timber harvest, and fires), which remove or reduce vegetative cover, and is usually expressed as a percent of watershed area (Belt, 1980). The index takes into account the initial percentage of crown removal and the recovery through regrowth of vegetation since the initial disturbance. For purposes of this assessment, ECA will be used to index changes in water yield through time based on timber harvest and roading disturbances.

There are a number of physical factors that determine the relationship between canopy conditions and water yield. These include interception, evapotranspiration, shading effects and wind flux. These factors affect the accumulation and melt rates of snow packs and how rainfall is processed. The ECA analysis takes into account the initial percentage of crown removal and the recovery through vegetative re-growth since the initial disturbance in the case of timber harvest or fire. Within the habitat types being treated under this project, the time frame for complete ECA recovery to occur is estimated to be 65 to 85 years (USDA Forest Service, 1974).

Additional factors affecting water yield include compacted surfaces due to roads, skid trails, and landings. Existing and new roads are considered as permanent openings in the ECA model. Decommissioned roads are considered as openings, so the road decommissioning projects do not contribute to reductions in ECA.

The ECA model does not directly account for the effects of peak flows. Peaks flows in the project area are nearly always associated with spring snowmelt, at times accompanied by rainfall. This can be seen in Figure E.3. Winter rain-on-snow events are historically rare and only infrequently exceed the spring runoff peak. About 3 percent of annual peak flow events have occurred during the winter months of November through March (USDA Forest Service, 1998). The effects of peaks flows are considered using professional judgment in the interpretation of ECA effects on stream channels.

Various ECA thresholds of concern have been in use in the Northern Region since the 1960s (Gerhardt, 2000). Early cutting guides recommended a limit of 20-30 percent ECA within a watershed (Haupt, 1967). More recently, ECA thresholds have been rejuvenated through consultation under the Endangered Species Act. A recent Biological Opinion stipulated that watershed analysis should be conducted prior to actions that would increase ECA in 3rd to 5th order priority watersheds where ECA exceeds 15 percent (National Marine Fisheries Service, 1995).

Recently, concern over water yield changes relative to stream channel condition has focused on smaller headwater catchments. Research in the nearby Horse Creek watershed study have demonstrated instantaneous peak flow increase up to 34 percent and maximum daily flow increases up to 87 percent, resulting from road construction and timber harvest in small

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catchments (King, 1989). Recent observations have suggested that channel erosion from these streams may be contributing to increased bedload sediment in the 3rd order receiving channel (Gerhardt, 2002).

The studies by Belt (1980) and King (1989) have also served as field tests of the ECA procedure. Belt concluded that the ECA procedure is a rational tool for evaluation of hydrologic impacts of forest practices. King recommended local calibration of the model and a greater emphasis on conditions in 1st and 2nd order headwater streams.

The Matrix of Pathways and Indicators of Watershed Condition for Chinook, Steelhead, and Bull Trout is a tool adopted by federal agencies to index existing habitat condition (NFMS, et al 1997). ECA is one of several indicators used in the matrix. High quality habitat is associated with ECA of greater than 15% in a 5th code watershed and all internal 6th code subwatersheds, moderate quality is associated with 15-20% ECA in a 5th code watershed, with one or more internal 6th code subwatersheds at 15-30% ECA, and low quality is associated with ECA of greater than 20% in a 5th code watershed, with one or more internal 6th code subwatersheds at greater than 30%. Using these parameters the following tables indicate that the Red River watershed is currently at a moderate habitat condition. Alternatives B, C, and D would not improve this situation but instead would add more 6th code subwatersheds to the 15-20% category. Currently Dawson Creek, Little Moose Creek, Blanco Creek, and Deadwood Creek are greater than 15% and therefore drop Red River watershed into the moderate category. Under Alternatives B, C and D the above 4 listed subwatersheds continue to be greater than 15% and Ditch Creek, Schooner Creek, and French Gulch are raised to the greater than 15% category.

Table H-1: Equivalent Clearcut Area per Alternative

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dawson Creek	A	26	25	24	23	22	21	20	19	19	18
	B	26	25	24	23	22	22	21	20	19	19
	C	26	25	24	23	22	21	21	20	19	19
	D	26	25	24	23	22	21	21	20	19	19
	E	26	25	24	23	22	21	21	20	19	19

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lower Main Red River*	A	9	9	8	9	8	8	8	8	7	7
	B	9	9	14	13	13	13	13	12	11	11
	C	9	9	12	12	12	12	11	11	11	10
	D	9	9	12	12	11	11	11	10	10	10
	E	9	9	11	11	11	11	10	10	10	9

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Siegel Creek	A	8	8	8	8	8	7	7	7	7	6
	B	8	8	13	12	12	12	11	11	10	10
	C	8	8	13	12	12	12	11	11	10	10
	D	8	8	11	10	10	10	10	9	9	8
	E	8	8	11	11	10	10	10	9	9	8
6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ditch Creek	A	14	14	13	13	12	12	12	11	11	11
	B	14	14	20	19	19	19	18	18	17	16
	C	14	14	18	18	17	17	17	16	15	15
	D	14	14	14	14	13	13	12	12	12	11
	E	14	14	14	14	13	13	13	12	12	11

6 th Code HUC		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Trail Creek	A	4	4	4	4	4	4	3	3	3	3
	B	4	4	4	4	4	4	4	4	4	4

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6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Otterson Creek	A	0	0	0	0	0	0	0	0	0	0
	B, C	0	0	0	0	0	0	0	0	0	0
	D, E										

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bridge Creek	A	1	1	1	1	1	1	1	1	1	1
	B, C	1	1	1	1	1	1	1	1	1	1
	D, E										

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Upper Main Red River	A	9	9	8	8	8	8	7	7	7	7
	B, C	9	9	8	8	8	8	8	7	7	7
	D, E										

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Baston Creek	A	5	5	5	5	4	4	4	4	4	4
	B, C	5	5	5	5	4	4	4	4	4	4
	D, E										

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Soda Creek	A	12	12	12	11	11	11	10	10	10	10
	B	12	12	15	15	14	14	14	14	13	12
	C	12	12	14	14	13	13	13	13	12	12
	D	12	12	12	12	12	11	11	11	11	10
	E	12	12	12	12	12	11	11	11	10	10

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Main Red River*	A	7	6	5	6	6	6	5	5	5	5
	B	7	6	13	13	13	12	12	12	11	10
	C	7	6	11	11	11	11	11	10	10	9
	D	7	6	10	10	9	9	9	9	8	8
	E	7	6	9	9	9	8	8	8	8	7

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Schooner Creek	A	12	12	11	11	10	10	10	10	9	9
	B	12	12	18	18	17	17	17	16	15	15
	C	12	12	18	18	17	17		16	15	15
	D	12	12	18	18	17	17	17	16	15	15
	E	12	12	18	17	17	17	16	16	15	15

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Trapper Creek*	A	9	9	8	8	8	8	7	7	7	7
	B, C	9	9	11	10	10	10	10	9	9	9
	D, E										

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Pat Brennan Creek	A	14	13	13	12	12	12	11	11	11	10
	B, C	14	13	13	12	12	12	11	11	11	10
	D, E										

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6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lower South Fork Red River*	A	9	9	8	8	8	8	7	7	7	7
	B, C D, E	9	9	11	10	10	10	10	10	9	9

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Upper South Fork Red River	A	9	9	8	8	8	8	7	7	7	7
	B, C D, E	9	8	9	9	9	8	8	8	8	8

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Middle Fork Red River	A	6	5	5	5	5	5	5	5	5	4
	B, C D, E	6	5	5	5	5	5	5	5	5	4

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
West Fork Red River	A	5	5	5	5	4	4	4	4	4	4
	B, C D, E	5	5	5	5	4	4	4	4	4	4

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Moose Butte Creek	A	11	11	11	10	10	10	10	9	9	9
	B, C D, E	11	11	11	11	10	10	10	9	9	9

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Little Moose Creek	A	16	16	15	14	14	14	13	13	12	12
	B	16	16	17	16	15	15	15	14	13	13
	C	16	16	16	15	15	15	14	14	13	13
	D	16	16	16	15	15	15	14	14	13	13
	E	16	16	16	15	15	14	14	14	13	13

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Blanco Creek	A	19	18	18	17	17	16	15	15	14	14
	B	19	18	28	27	27	26	26	25	23	22
	C	19	18	24	24	23	22	22	21	20	19
	D	19	18	24	23	23	22	22	21	20	19
	E	19	18	25	24	24	23	22	22	21	19

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Deadwood Creek	A	17	17	16	16	15	15	14	14	14	13
	B, C D, E	17	17	17	17	16	16	16	15	15	14

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Red Horse Creek	A	6	6	6	6	5	5	5	5	5	5
	B	6	6	8	8	8	8	7	7	7	6
	C	6	6	8	8	8	8	7	7	7	6
	D	6	6	7	7	6	6	6	6	6	5
	E	6	6	7	7	6	6	6	6	6	5

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6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
French Gulch	A	14	13	13	12	12	12	11	11	10	10
	B	14	14	20	19	19	19	18	18	16	16
	C	14	14	20	19	19	19	18	18	16	16
	D	14	14	16	15	15	14	14	14	13	12
	E	14	13	16	15	15	14	14	13	13	12

6 th Code HUC	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Campbell Creek	A	14	13	13	12	12	12	11	11	11	10
	B	13	13	14	14	13	13	13	12	12	11
	C	13	13	14	14	13	13	13	12	12	11
	D	13	13	14	14	13	13	12	12	12	11
	E	14	13	14	14	13	13	13	12	12	11

6 th Code HUC		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lowest Main Red River*	A	10	10	9	9	9	9	8	8	8	8
	B	10	10	14	14	13	13	13	12	12	11
	C	10	10	13	13	13	12	12	12	11	10
	D	10	10	12	12	12	11	11	11	10	10
	E	10	10	12	12	11	11	11	11	10	10

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

NEZSED

Sediment yield is defined as the movement of sediment past a point in the stream system over a certain time period. Sediment yield can be sampled in the field utilizing a variety of methods. The most common method consists of sampling suspended sediment, bedload sediment, and stream discharge. Sediment yield can also be modeled using one of several approaches.

NEZSED is a computer model tiered to the R1R4 guidelines (Cline, et al, 1981), developed by hydrologists and soil scientists from the Intermountain Research Station and the Northern and Intermountain Regions of the Forest Service. The model estimates the average annual natural or base rate of sediment yield, and surface erosion sediment yield produced from roads, logging, and fire. The model is limited in that it does not consider the effects of activities on mass erosion greater than 10 cubic yards. It also does not include the effects of grazing and most instream and mining activities. Effects of land uses other than roads, logging and fire are analyzed using other information and techniques.

For this analysis, NEZSED was used to model timber harvest, temporary road construction, reconstruction of existing roads and road decommissioning. Activities under this project that are not modeled are soil restoration, trail improvements, recreation site improvements and stream channel restoration. The effects of these other activities were considered in the overall aquatic analysis and conclusions.

Though the model shows annual variations in response to land use, it does not estimate variations due to climate or weather events. NEZSED is not an event-based model in that sediment yield does not vary in accordance with specific assumed runoff or erosion events. It estimates average annual sediment yields. However, modeling coefficients are the result of a research base that includes the cumulative result of individual storm and runoff events. Thus, the effects of storm events are incorporated into the model coefficients, though the model results are expressed in terms of average annual yields.

Though NEZSED does not model large activity-related mass erosion events, effects of such events are considered in the effects analysis. This is done through mapping of landslide prone terrain and avoidance of areas deemed to possess high hazard and mitigation of areas deemed

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to possess moderate hazards. Mass erosion occurrences were also noted during field inventories.

Management thresholds for sediment yield were established in Appendix A of the Nez Perce National Forest Plan (USDA Forest Service, 1987). These include sediment yield guidelines, expressed as peak year percent over base sediment yield, and entry frequency guidelines, expressed as the number of times per decade that sediment yield guidelines can be equaled. For the Red Pines project, the sediment yield guidelines are found in Table III-17.

NEZSED has been tested against field sampled data in several studies at three scales of watersheds across the Nez Perce National Forest (Gerhardt, 2005). The first study compared measured and modeled natural sediment yields at fifteen small watersheds that are tributaries to Horse Creek, which is a tributary of the Meadow Creek watershed draining into the Lower Selway Subbasin (Gerhardt and King, 1987). These watersheds ranged in size from 0.08 to 0.57 square miles. Annual sediment yield was sampled with sediment detention basins, suspended sediment samples, and streamflow gaging. Of the fifteen tributaries sampled, the model over-predicted sediment yield on nine sites and under-predicted on six sites. The mean result was that the model over-predicted by about 23 percent.

The second study evaluated data from eight stream gaging stations on the Nez Perce National Forest, ranging in size from 5.7 to 113 square miles. Three of these were located within the South Fork Clearwater Subbasin (Gloss, 1995). At six stations, the field data consisted of suspended and bedload sediment samples, along with streamflow gaging. At two stations, sediment yield was estimated through the use of sediment detention basins and streamflow gaging. This study found that NEZSED under-predicted sediment yields at six stations and over-predicted at two stations, when compared to observed data from field sampling during water years 1986 through 1993. For the three stations within the South Fork Clearwater Subbasin, field-sampled sediment yields averaged about 30 tons/mi²/yr. and modeled sediment yields averaged about 12 tons/mi²/yr. In general, the model predicted better in average to below average water years, and more significantly under-predicted in above average water years.

A third study to test the NEZSED model compared field sampled and modeled sediment yield at the subbasin scale, using data from the South Fork Clearwater and Selway Rivers. Sampling in both rivers occurred between 1988 and 1992 and consisted of 52 suspended sediment samples. The South Fork data were collected at the Mt. Idaho Bridge, near the forest boundary where the watershed area is about 830 square miles. When calculated as annual sediment yield, these data suggest an annual sediment yield at this site of 17,880 tons/year, or about 22 tons/mi²/yr. Sediment yield predictions at this site, based on NEZSED, were estimated to be 15,080 tons per year, or about 18 tons/mi²/yr (USDA Forest Service, 1998).

The Selway River data were collected at the USGS gage near Ohara Creek, where the watershed area is about 1910 square miles. When calculated as annual sediment yield, these data suggest a sediment yield at this site of 54,900 tons/year, or if adjusted to the mouth, 55,700 tons/year. The watershed area at the mouth is 1974 square miles, so the sediment production is 28 tons/mi²/yr. Sediment predictions based on modeled sediment at the mouth of the Selway River were 54,400 tons/year or about 27.5 tons/mi²/yr (USDA Forest Service, 2001).

A fourth study (Thomas and King, 2004) tested NEZSED against measured data at stream gages in Red River and South Fork Red River. Results showed that NEZSED predicted 74 percent and 89 percent, respectively, of field-sampled sediment yield over a 16-year period at these two gaging stations. The model results were closer to measured values at these two stations than found in the Gloss study.

Comparison of Modeled Sediment Yield by Alternative

The following tables show the sediment yield percent over base for each alternative including existing condition. These tables reflect the Nezsed model based on proposed activities. Note the activities are modeled over a 10-year period with estimated activity implementation year projected as 2005. Column 2 of each table represents the current threshold as outlined in the Forest Plan.

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Under existing condition Moose Butte Creek subwatershed currently exceeds the Forest Plan Guidelines. Under Alternatives B, C, D, and E this figure remains the same. This is due to no harvest or fire activities are proposed within the subwatershed, and the amount of road decommissioning is so minimal that it does not reduce the overall long-term proposed sediment yield. In Alternatives b and C Lower Main Red River, Ditch Creek, Soda Creek, and Main Red River exceed the Forest Plan Guidelines, while in Alternatives D and E only Lower Main Red River exceeds the guidelines.

Table H-2: Sediment Yield Percent over Base per Alternative

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dawson Creek	60	A	39	39	39	39	39	39	39	39	39	39
		B	39	39	38	34	32	32	32	32	32	32
		C	39	39	38	35	32	32	32	32	32	32
		D	39	39	38	35	32	32	32	32	32	32
		E	39	39	38	33	30	30	30	30	30	30
6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lower Main Red River*	20	A	22	22	22	22	22	22	22	22	22	22
		B	22	22	32	22	20	19	19	18	18	18
		C	22	22	32	22	20	20	19	19	19	19
		D	22	22	28	21	20	20	20	20	20	20
		E	22	22	27	21	20	20	19	19	19	19

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Siegel Creek	35	A	23	23	23	23	23	23	23	23	23	23
		B	23	23	33	25	23	23	23	23	23	23
		C	23	23	33	25	23	23	23	23	23	23
		D	23	23	27	23	23	23	23	23	23	23
		E	23	23	26	24	23	23	23	23	23	23

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ditch Creek	30	A	26	26	26	26	26	26	26	26	26	26
		B	26	26	60	26	23	22	20	20	20	20
		C	26	26	58	26	23	22	21	21	21	21
		D	26	26	27	24	23	23	23	23	23	23
		E	26	26	30	19	15	15	15	15	15	15

6 th Code HUC	Forest Plan Guidelines		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Trail Creek	30	A	14	14	14	14	14	14	14	14	14	14
		B	14	14	16	13	12	12	12	12	12	12
		C	14	14	16	13	12	12	12	12	12	12
		D	14	14	16	14	14	14	14	14	14	14
		E	14	14	14	12	12	12	12	12	12	12

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Otterson Creek	30	A, B, C, D, E	0	0	0	0	0	0	0	0	0	0

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6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bridge Creek	30	A	13	13	13	13	13	13	13	13	13	13
		B, C D, E	13	13	13	13	13	13	13	13	13	13

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Upper Main Red River	30	A	25	25	25	25	25	25	25	25	25	25
		B, C D, E	25	25	25	25	25	25	25	25	25	25

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Baston Creek	15	A	8	8	8	8	8	8	8	8	8	8
		B, C D, E	8	8	8	8	8	8	8	8	8	8

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Soda Creek	30	A	22	22	22	22	22	22	22	22	22	22
		B	22	22	39	21	16	16	15	15	15	15
		C	22	22	38	21	16	16	15	15	15	15
		D	22	22	21	17	16	15	15	15	15	15
		E	22	22	25	18	16	16	16	16	16	16

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Main Red River*	25	A	20	20	20	20	20	20	20	20	20	20
		B	20	20	34	22	20	19	18	18	18	18
		C	20	20	33	22	20	19	18	18	18	18
		D	20	20	26	21	19	19	18	18	18	19
		E	20	20	24	19	18	18	17	17	17	17

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Schooner Creek	35	A	22	22	22	22	22	22	22	22	22	22
		B, C D, E	22	22	29	22	20	19	19	19	19	19

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Trapper Creek*	30	A	11	11	11	11	11	11	11	11	11	11
		B, C D, E	11	11	11	10	9	9	9	9	9	9

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

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6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Pat Brennan Creek	60	A	13	13	13	13	13	13	13	13	13	13
		B, C D, E	13	13	13	11	9	9	9	9	9	9

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lower South Fork Red River*	30	A	15	15	15	15	15	15	15	15	15	15
		B, C D, E	15	15	17	14	13	13	13	13	13	13

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Upper South Fork Red River	35	A	10	10	10	10	10	10	10	10	10	10
		B, C D, E	10	10	10	9	9	9	9	9	9	9

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Middle Fork Red River	35	A	10	10	10	10	10	10	10	10	10	10
		B, C D, E	10	10	10	10	10	10	10	10	10	10

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
West Fork Red River	30	A	6	6	6	6	6	6	6	6	6	6
		B, C D, E	6	6	6	6	6	6	6	6	6	6

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Moose Butte Creek	30	A	37	37	37	37	37	37	37	37	37	37
		B, C D, E	37	37	37	37	37	37	37	37	37	37

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Little Moose Creek	60 (45% as amended)	A	39	39	39	39	39	39	39	39	39	39
		B, C D, E	39	39	40	28	23	23	23	23	23	23

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6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Blanco Creek	60	A	37	37	37	37	37	37	37	37	37	37
		B	37	37	41	25	20	19	19	19	18	18
		C	37	37	39	24	20	19	19	19	19	19
		D	37	37	39	25	20	20	20	20	20	20
		E	37	37	39	24	19	19	19	19	18	18

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Deadwood Creek	60 (45% as amended)	A	34	34	34	34	34	34	34	34	34	34
		B, C D, E	34	34	34	30	27	27	27	27	27	27

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Red Horse Creek	30	A	13	13	13	13	13	13	13	13	13	13
		B	13	13	16	14	13	13	13	13	13	13
		C	13	13	16	14	13	13	13	13	13	13
		D	13	13	14	13	13	13	13	13	13	13
		E	13	13	14	13	13	13	13	13	13	13
6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
French Gulch	60	A	17	17	17	17	17	17	17	17	17	17
		B	17	17	29	20	18	18	17	17	17	17
		C	17	17	29	20	18	18	17	17	17	17
		D	17	17	17	17	17	17	17	17	17	17
		E	17	17	17	17	17	17	17	17	17	17

6 th Code HUC	Forest Plan Guidelines	Alt.	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Campbell Creek	60	A	26	26	26	26	26	26	26	26	26	26
		B, C D, E	26	26	30	23	22	21	20	20	20	20

6 th Code HUC	Forest Plan Guidelines		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lowest Main Red River*	30**	A	23	23	23	23	23	23	23	23	23	23
		B	23	23	32	23	21	20	20	20	20	20
		C	23	23	31	22	20	20	20	20	20	20
		D	23	23	28	22	20	20	20	20	20	20
		E	23	23	27	21	20	20	19	19	19	19

*This 6th Code HUC is a composite watershed. For analysis purposes it is combined with upstream prescription watersheds to form a true watershed.

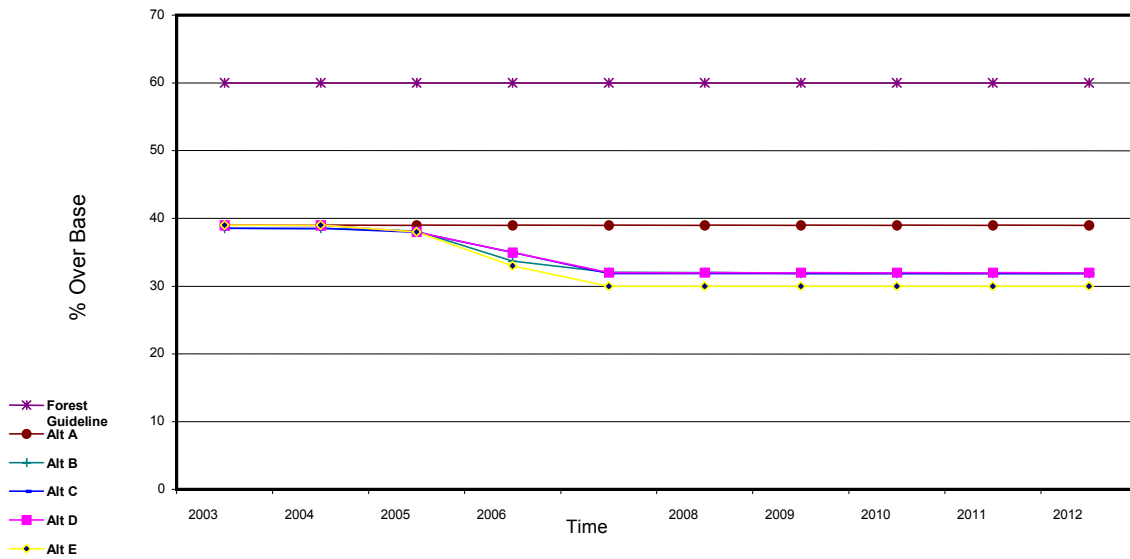
** As established by the Forest Plan Amendments within this EIS document. See Appendix D of the Forest Plan.

The following series of graphs display, by subwatershed, the NEZSED results percent over base by alternative. Additionally each graph displays the existing forest plan sediment yield guidelines to meet fish water quality objectives. In summary, the sediment peaks displayed are during the implementation year of 2005 and then, in the majority of the subwatersheds the long-term sediment decreases and is less than the existing. This overall decrease is primarily a result of

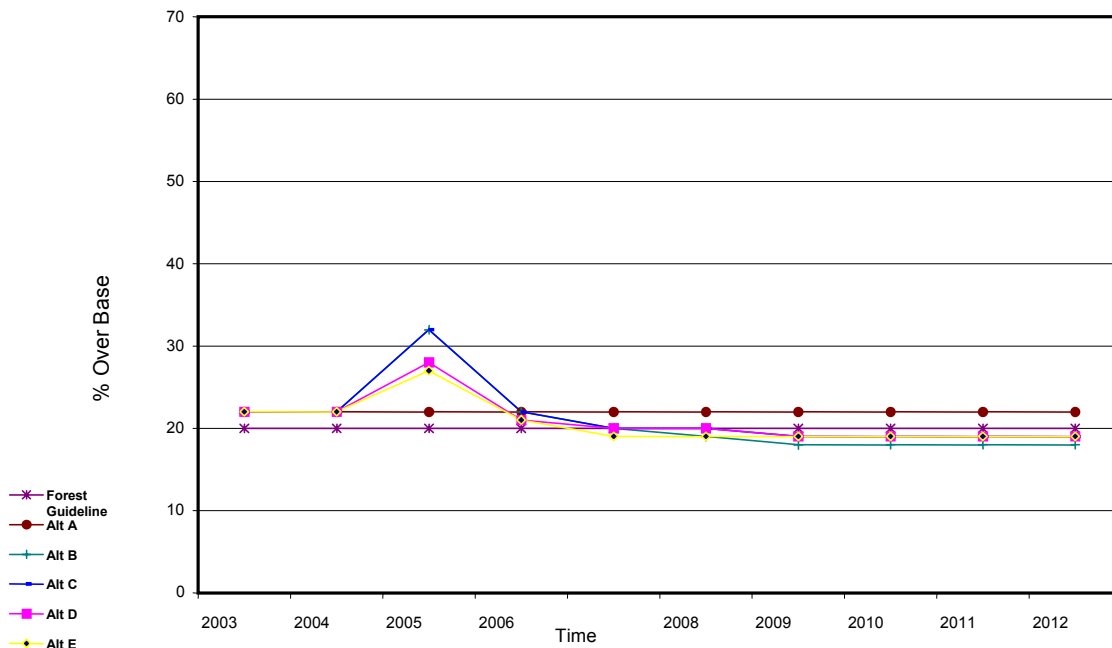
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the proposed road decommissioning within each subwatershed.

Graph H-1: Dawson Creek Sediment % Over Base

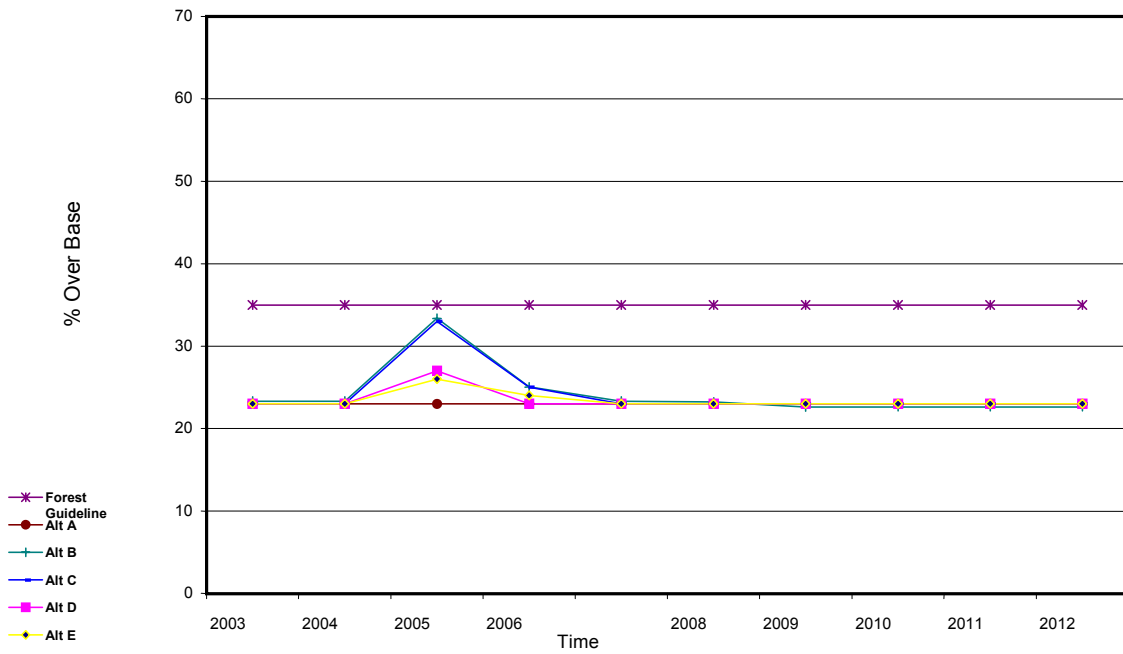


Graph H-2: Lower Red River Sediment % Over

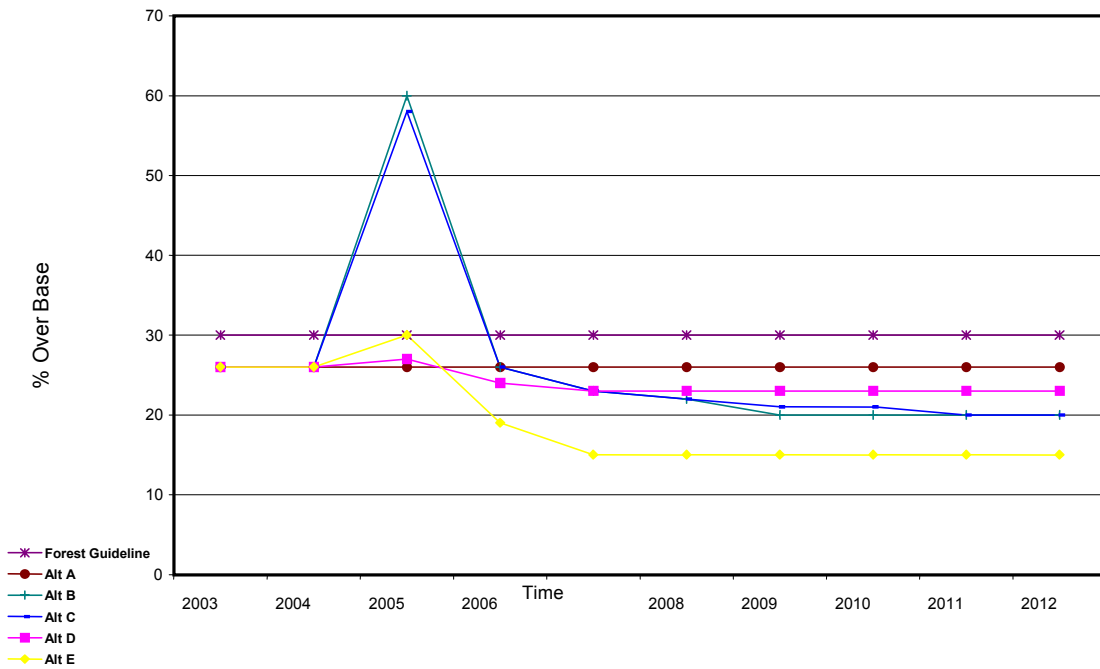


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Graph H-3: Siegel Creek Sediment % Over

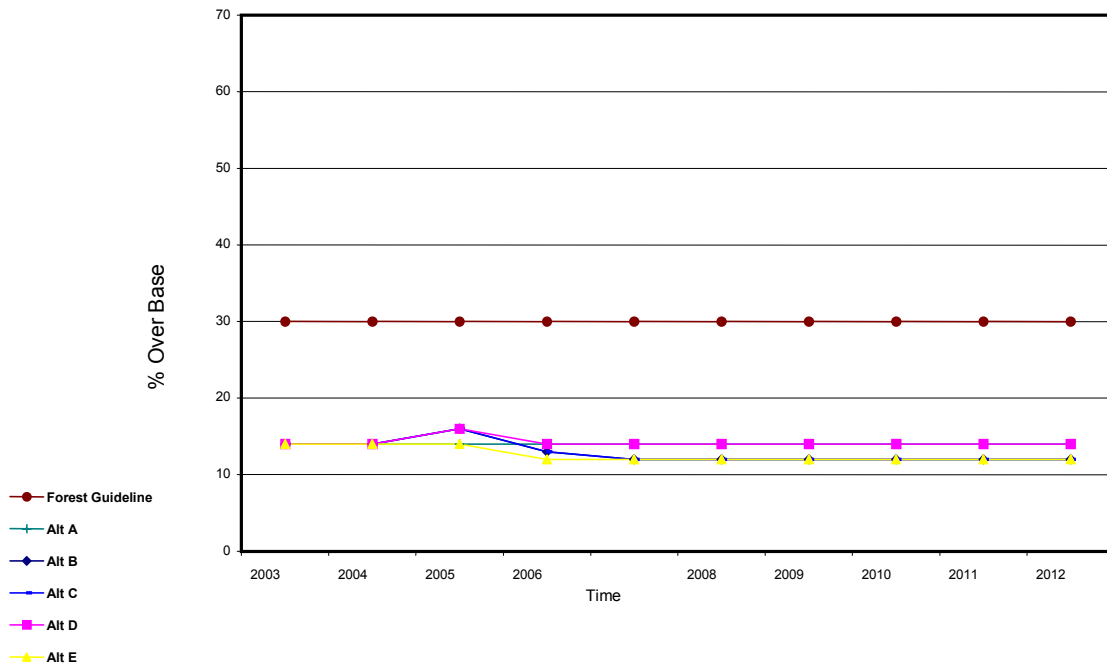


Graph H-4: Ditch Creek Sediment % Over

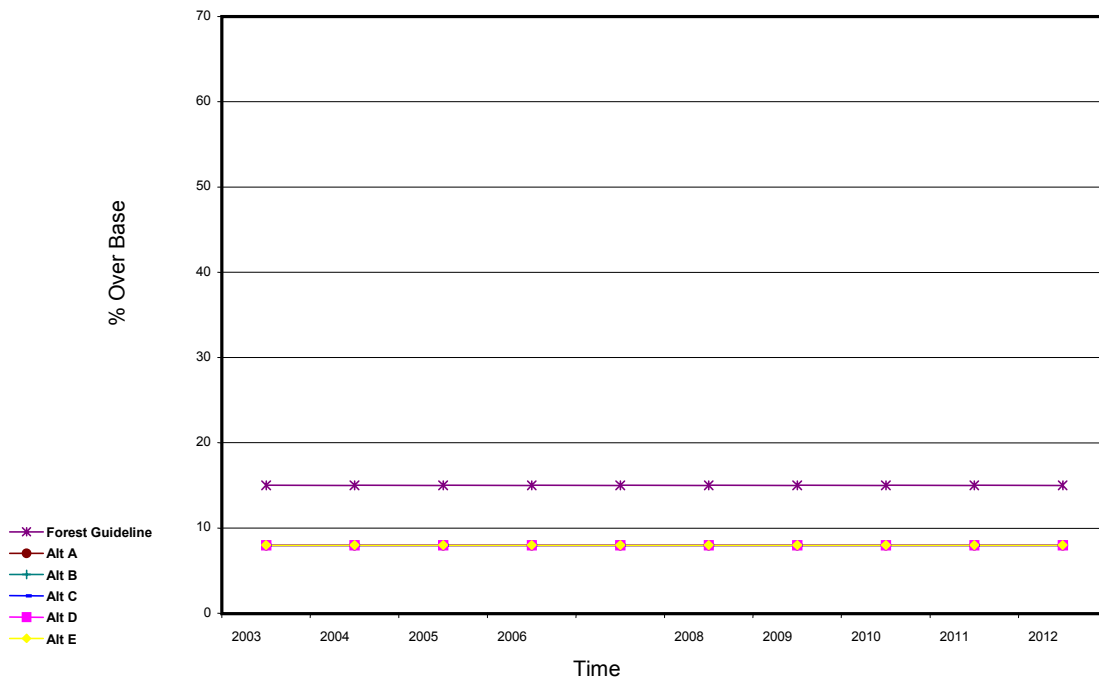


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Graph H-5: Trail Creek Sediment % Over

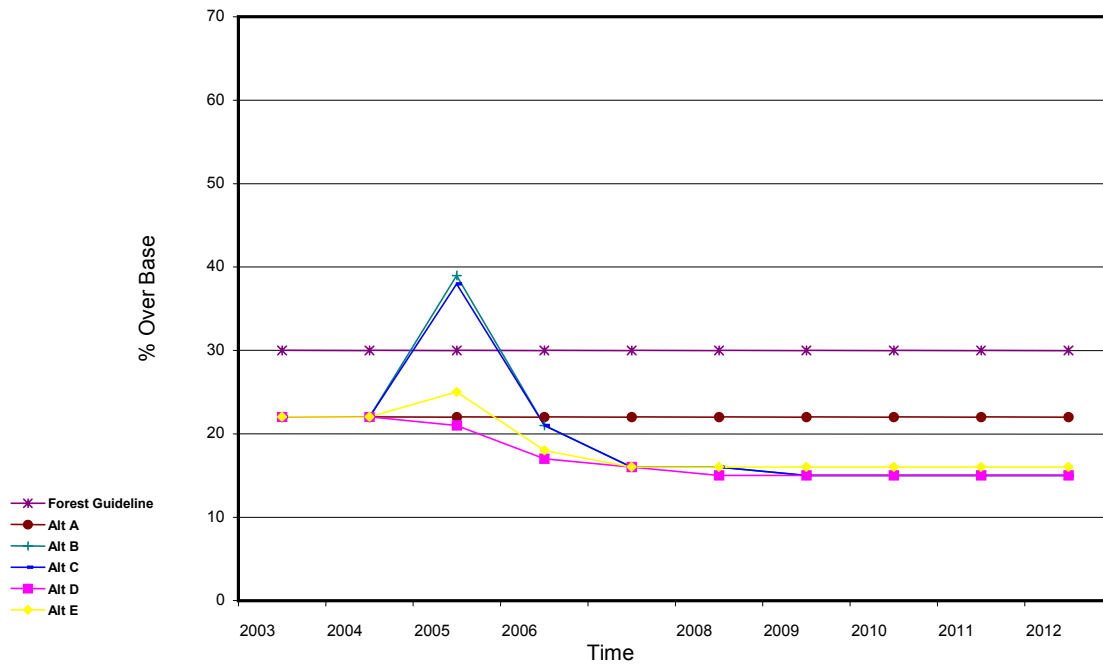


Graph H-6: Baston Creek Sediment % Over

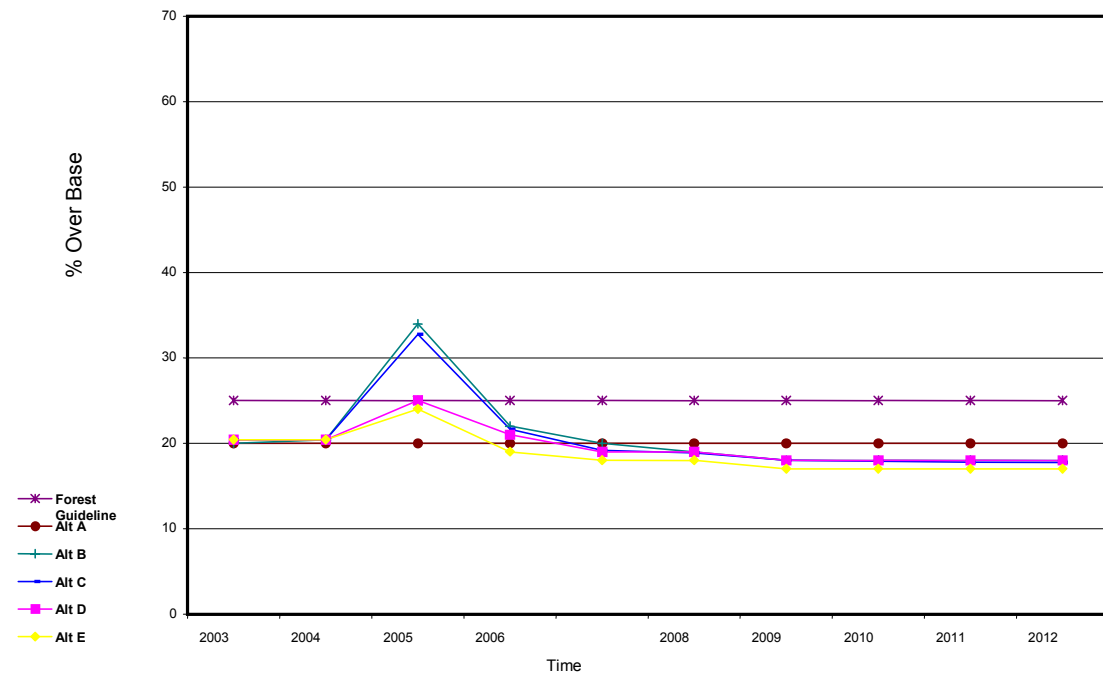


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Graph H-7: Soda Creek Sediment % Over Base

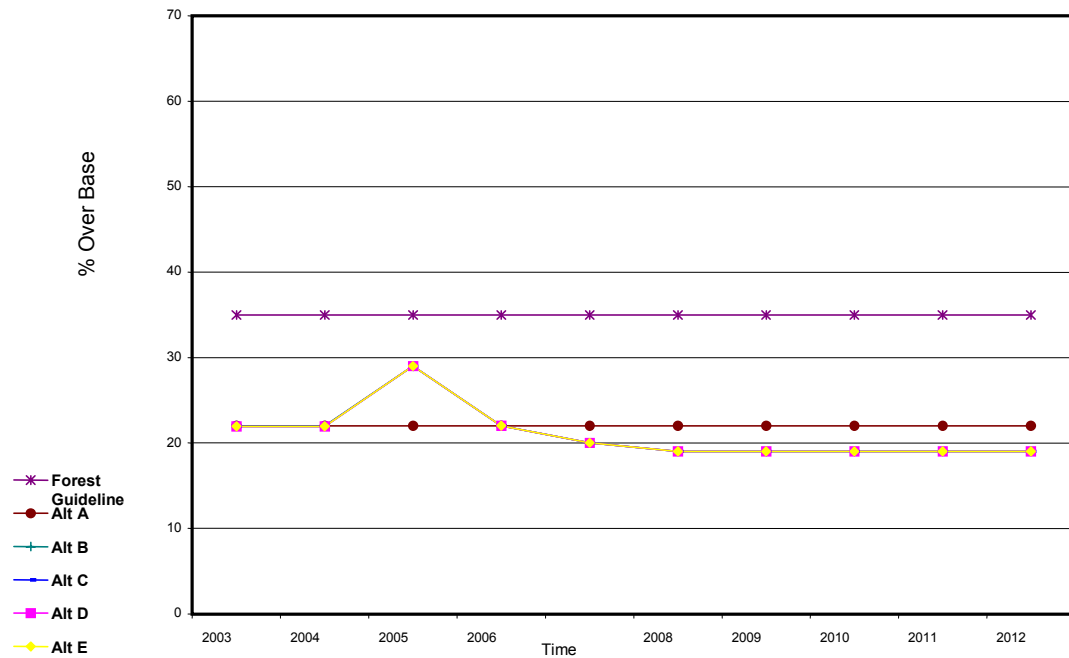


Graph H-8: Main Red River Creek Sediment % Over

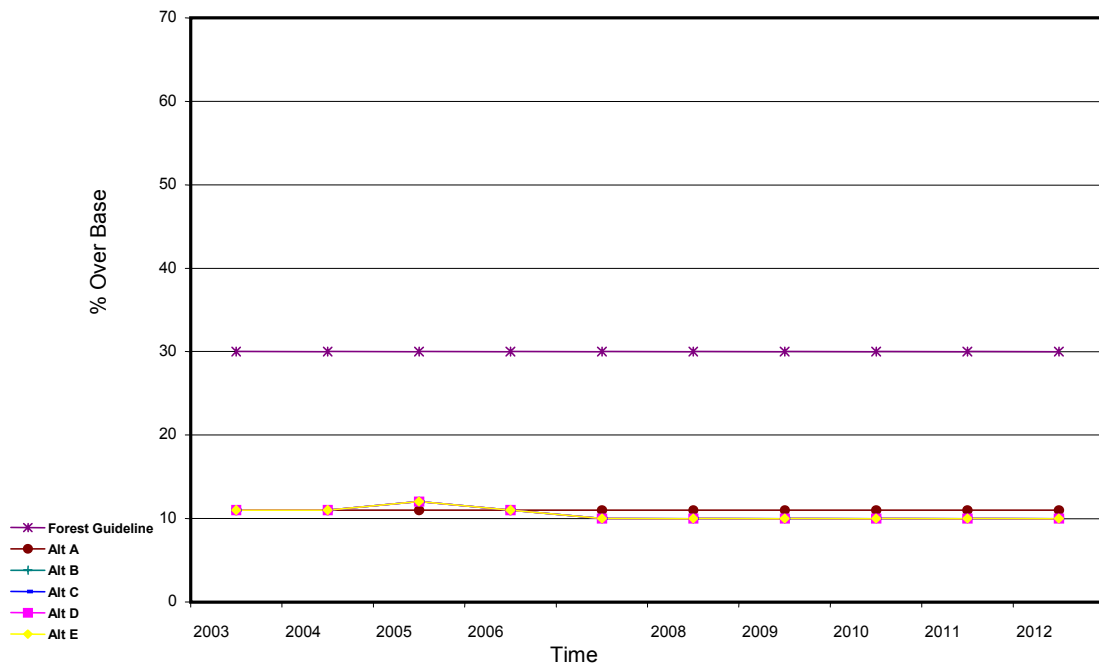


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Graph H-9: Schooner Creek Sediment % Over

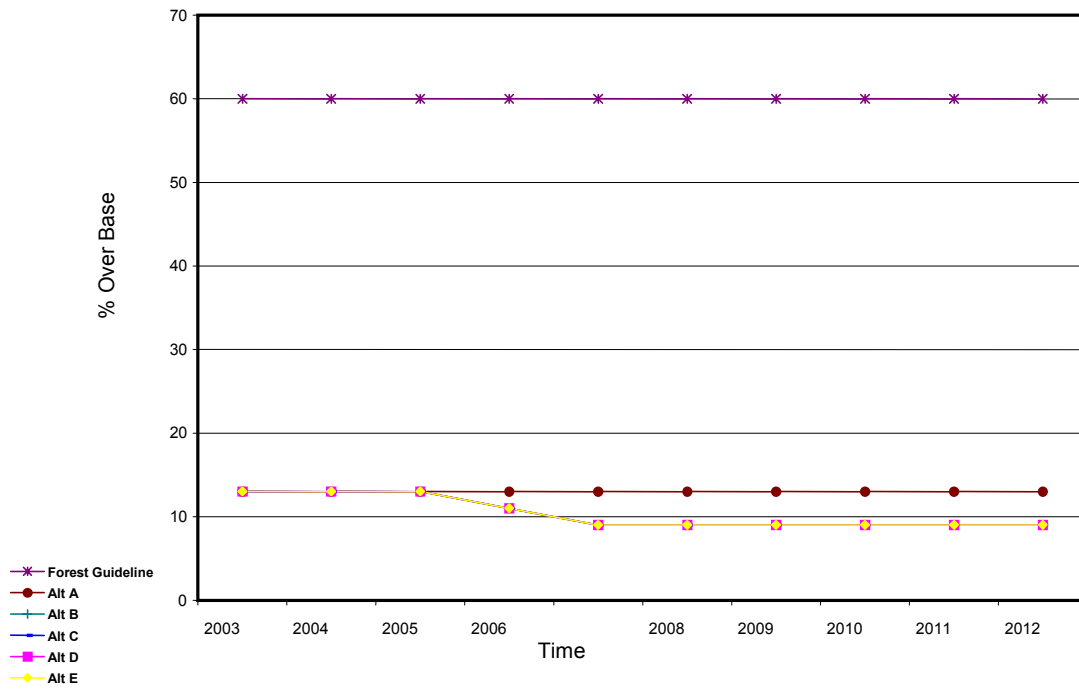


Graph H-10: Trapper Creek Sediment % Over Base

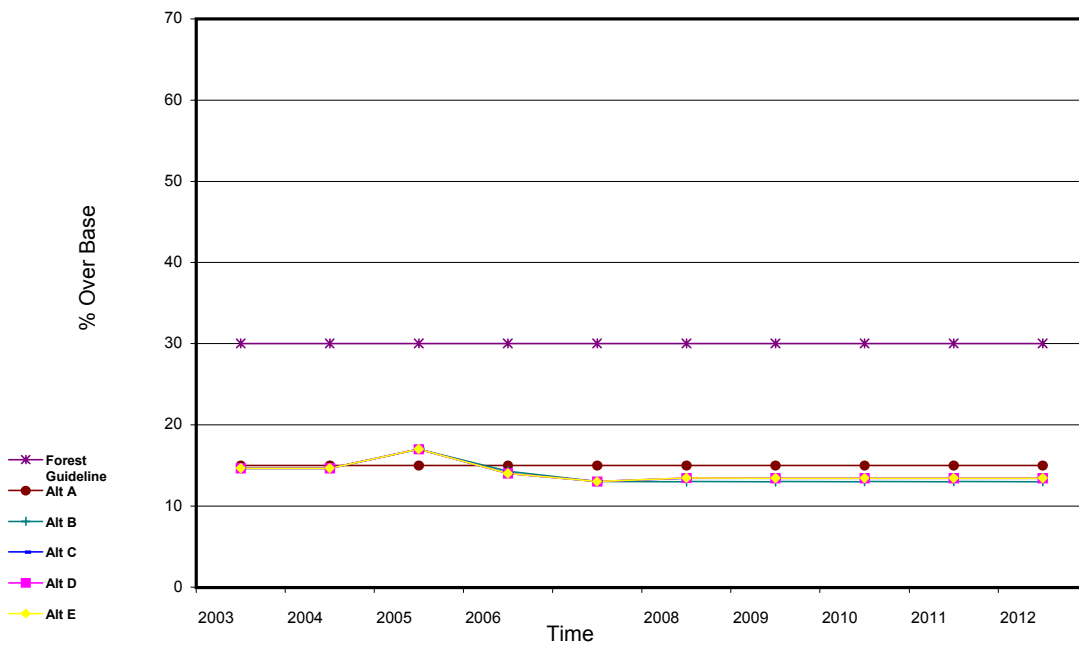


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Graph H-11: Pat Brennan Creek Sediment % Over Base

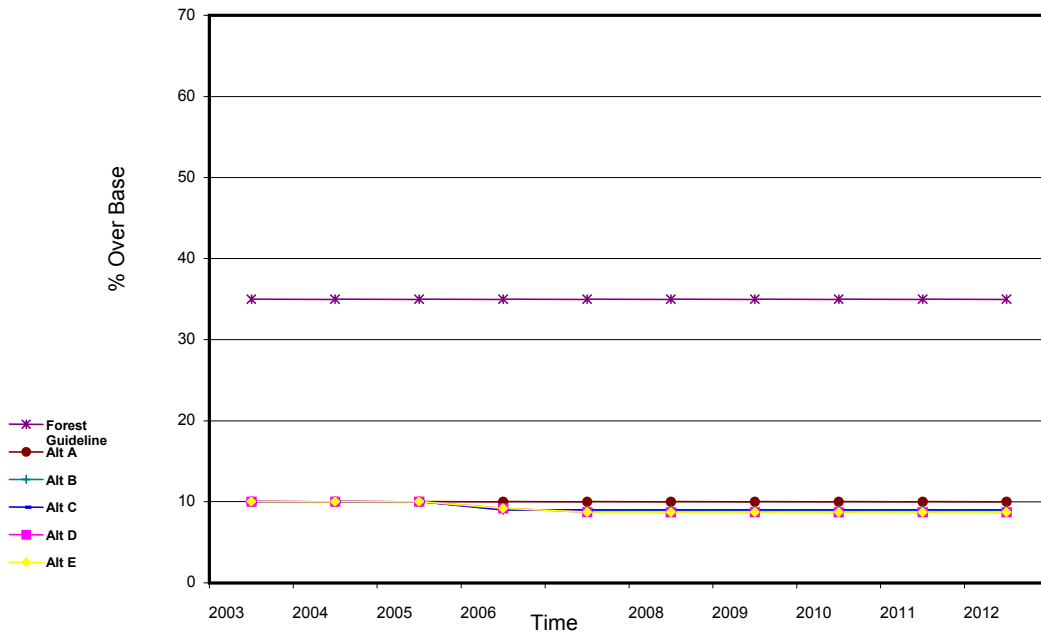


Graph H-12: Lower South Fork Red River Sediment % Over Base

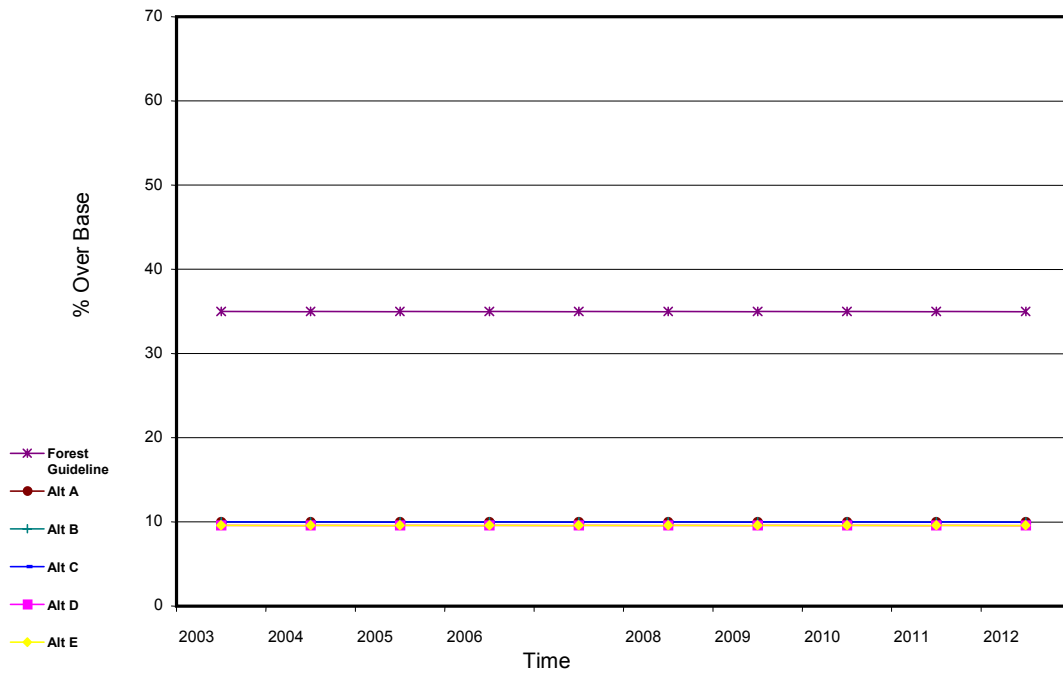


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Graph H-13: Upper South Fork Red River Sediment % Over Base

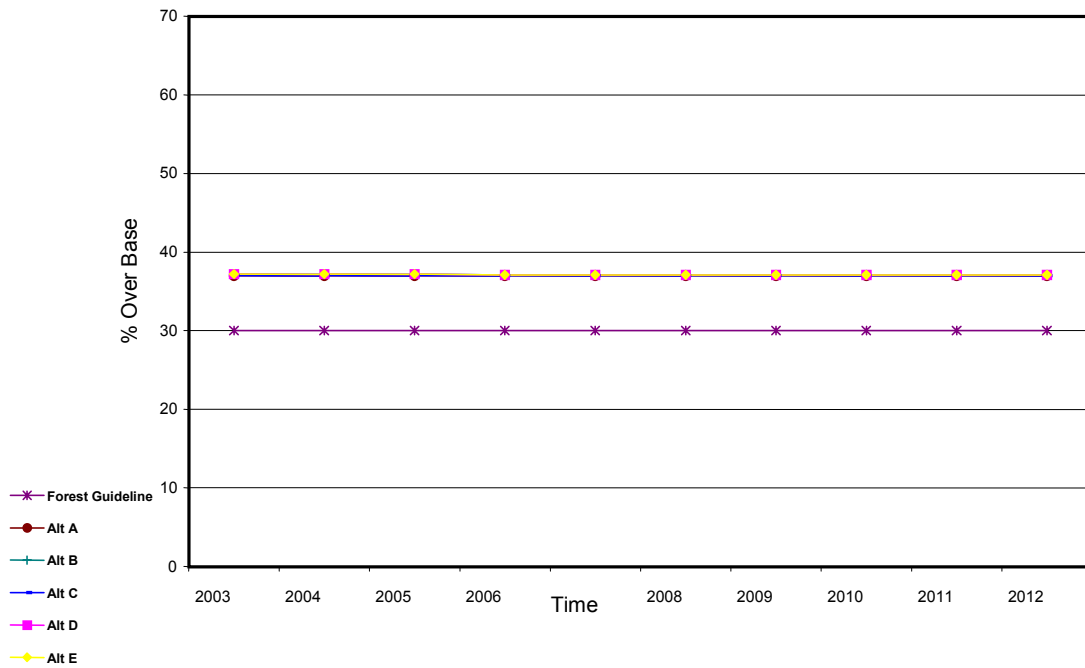


Graph H-14: Middle Fork Red River Sediment % Over Base

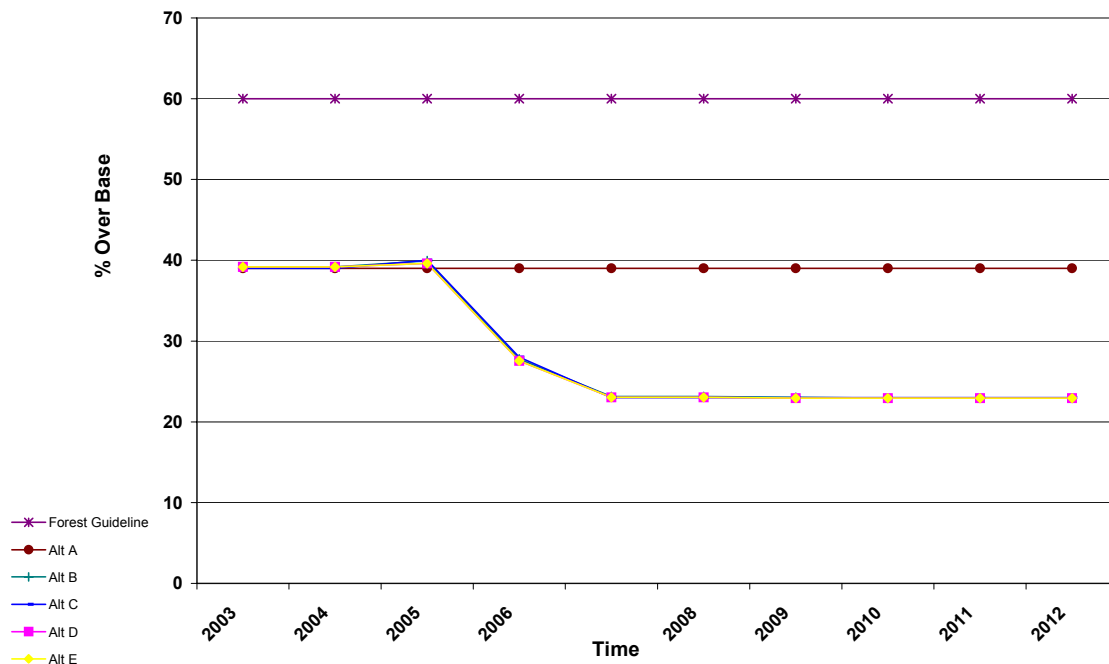


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Graph H-15: Moose Butte Creek Sediment % Over Base

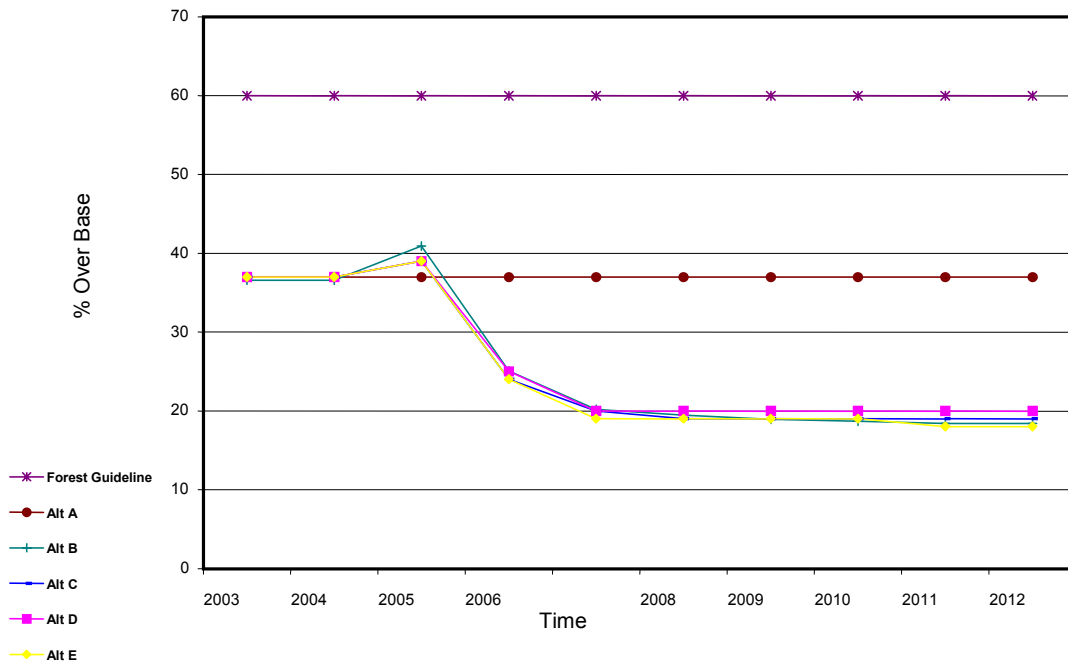


Graph H-16: Little Moose Creek Sediment % Over Base

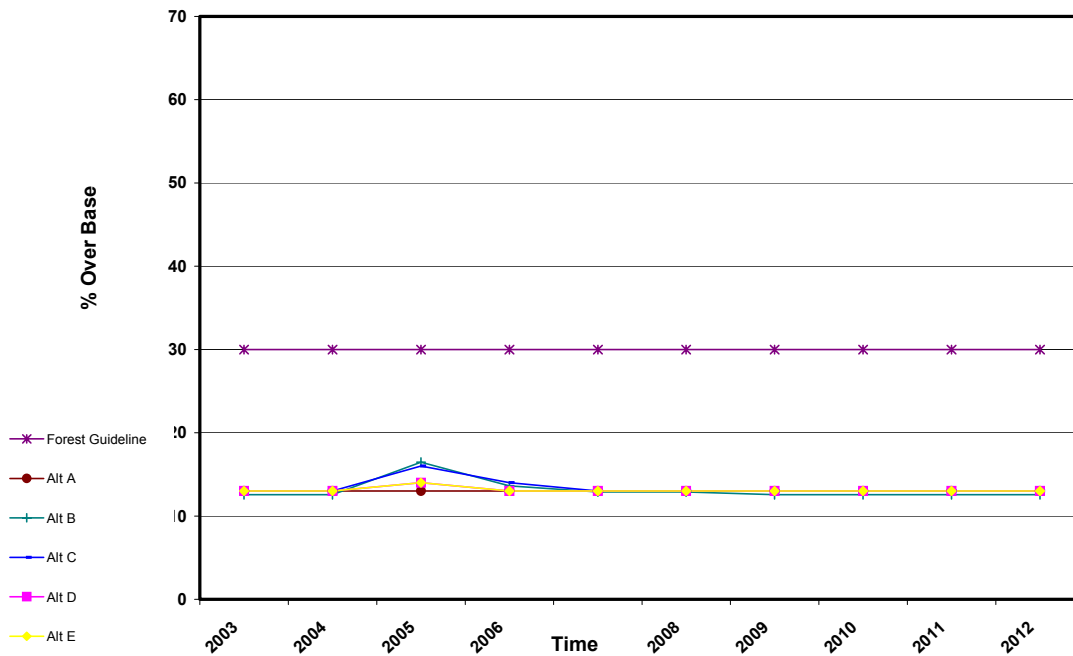


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Graph H-17: Blanco Creek Sediment % Over Base

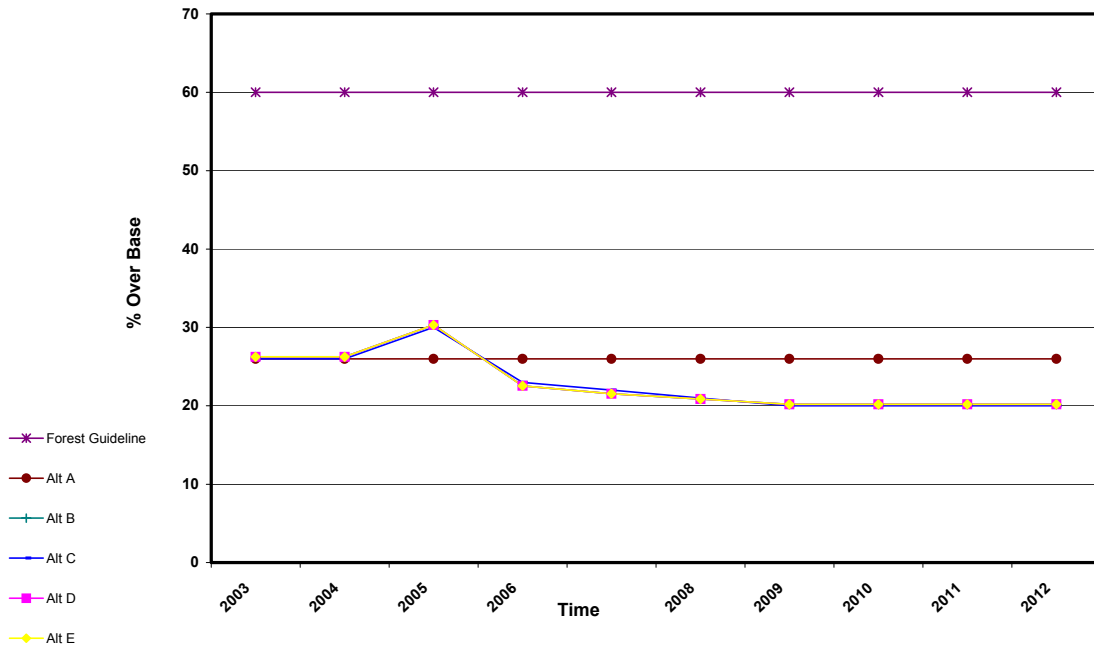


Graph H-18: Red Horse Creek Sediment % Over Base

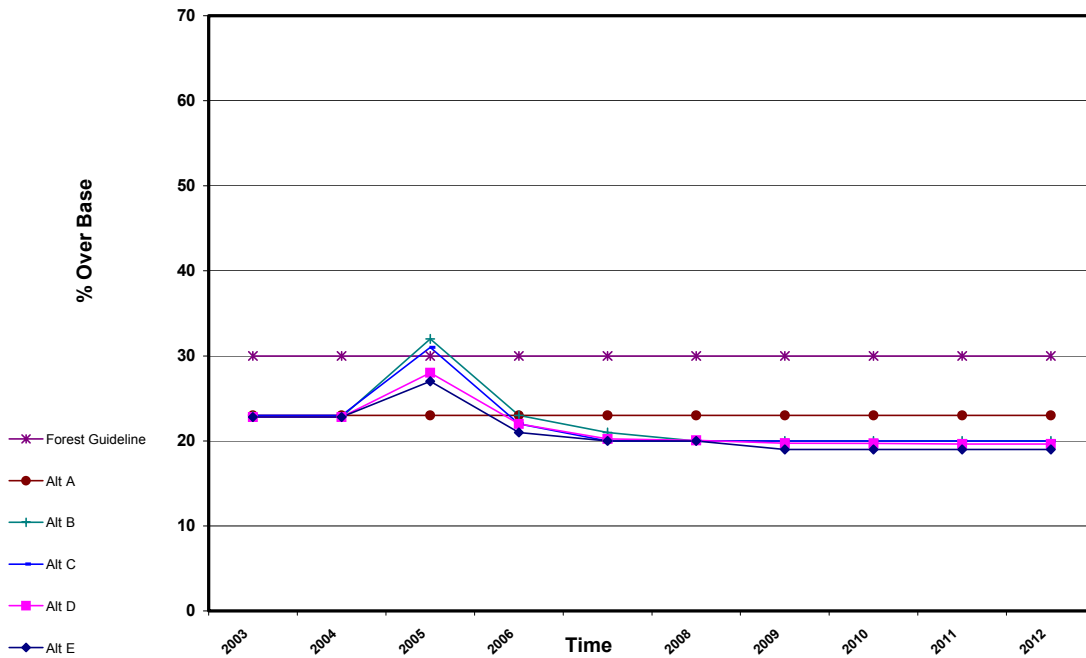


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Graph H-19: Campbell Creek Sediment % Over Base



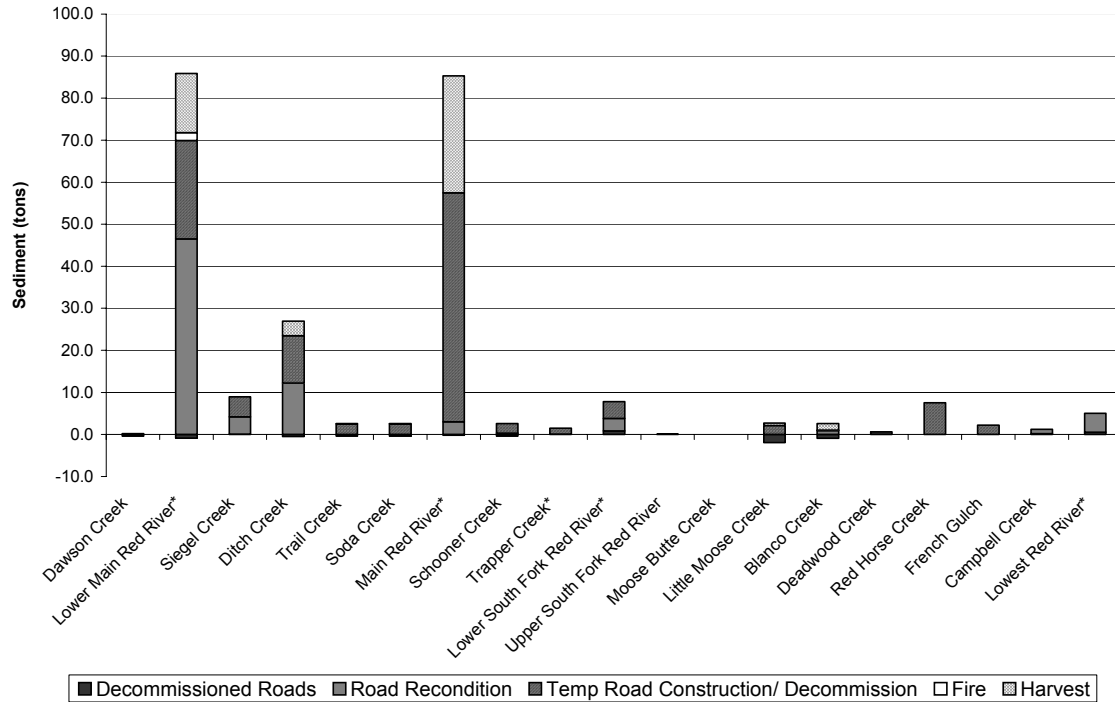
Graph H-20: Lowest Red River Sediment % Over Base



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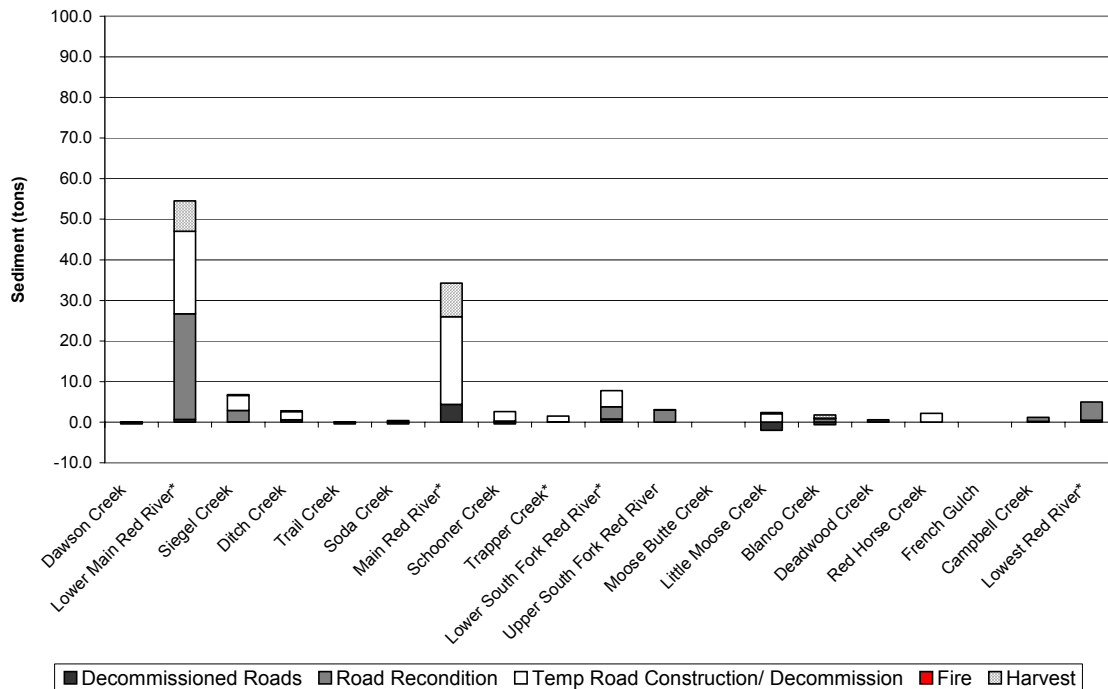
The following graph displays the tons of sediment by subwatershed for the activity year of 2005 for Alternative B. Alternative B and E are the only graphs displayed as they reflect the highest and the lowest generated sediment in those subwatersheds within the analysis area, as compared to Alternatives C, and D. Each bar reflects the tons of sediment generated by the activity. In Alternative B, road reconditioning and temporary road construction are the two largest producers of sediment during this time frame.

Graph H-21. Red Pines - 2005 Sediment by Activity & Subwatershed - Alt B



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Graph H-22. Red Pines - 2005 Sediment by Activity & Subwatershed - Alt E



FISHSED

The Guide for Predicting Salmonid Response to Sediment Yields in Idaho Batholith Watersheds (FISHSED model) has been used in this project to predict the effect of sediment yields on stream habitat and fish populations. This model is based on assumptions and has limitations.

The assumptions of the FISHSED model are listed in Appendix A of the model documentation (Stowell et al, 1983). Some of the key assumptions with influence on the limitations of this model include: 1) on those Forests in which mass erosion is a significant hazard, predicted sediment yield will include a mass erosion component. The American and Crooked River Project does not occur in a landscape where mass erosion is a significant hazard. 2) The relative response of salmonid fish populations to increased levels of sediment and percent fines in the substrate as depicted in laboratory studies approximates the response under natural conditions. The model documentation (p. 6) describes studies that support this assumption and others that show some differences.

The FISHSED model has other recognized limitations including: 1) the model simplifies an extremely complex physical and biological system and is developed from limited scientific knowledge (p. 2). The complex sequence of sediment movement from the slopes to the channel, transport down, and deposition in a channel reach, and its effect on fish habitats and populations; have not been fully described (p. 5). 2) The method was developed for watersheds and fish species associated with the Idaho Batholith (p. 4), using data from the Clearwater and Nez Perce National Forest. Given the source of the original data, the model is applicable to the Red Pines Project. 3) The specific fish response curves in this model were partially developed from laboratory experiments and may constitute only partial simulation of natural conditions (p. 6). 4) The model evaluates embryo survival, winter carrying capacity, and summer rearing capacity. While invertebrate insect abundance may be directly affected by sediment, the relationship between sediment deposition and invertebrate production is not included in the model (p.10). 5) The utilization of channel types to stratify fish response, particularly with respect to the modeling

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of “A” channel types, may not realistically represent changes in fish habitat (p. 21). 6) The model does not include a ‘recovery function’ that predicts the changes in substrate condition based on natural flow events. 7) The model was calibrated to the original Nez Perce Forest sediment model and landtypes, which have been updated since model development. No subsequent testing or validation of the model has occurred on the Forest. 8) The model outputs are reasonable estimates, but are not absolute numbers of high statistical precision (p. 6). As appropriate given this limitation, the model outputs have been used by the fisheries biologists in this project in combination with sound biological judgment.

SEDIMENT ROUTING DISCUSSION

(Nick Gerhardt, Forest Hydrologist, Nez Perce National Forest – 1/30/04 - Draft)

Introduction

Sediment routing considers the disposition of sediment within the watershed system, including processes of erosion, deposition, storage and transport. It includes upslope and instream components. The upslope component includes initial detachment, erosion and delivery efficiency. The instream component includes suspended and bedload sediment yield, as well as substrate deposition and composition. The instream component also includes consideration of streamflow and channel morphology, both of which influence the capability of the stream to transport or deposit sediment.

Erosion and Delivery Processes

The erosion process initiates with detachment of material. Detachment can occur through weathering processes such as frost heave or raindrop impact. Erosion can occur as dry ravel, surface erosion (e.g. sheet, rill and gully) and mass erosion (e.g. debris avalanches, slumps and earthflows). The rate of each is dependent on climate, landforms, geology, soils and exposure of mineral soil. For freshly exposed materials, surface erosion is probably the dominant process in the Red River landscape. Transport occurs when rainfall or snowmelt generate water in sufficient quantities to carry the detached materials.

In most cases, a large proportion of eroded material is stored on the landscape without being delivered to the channel system. Storage can take place in hollows and flats or behind obstructions. It can also occur on slopes if the water transporting the material infiltrates. Delivery efficiency has been estimated for each landtype on the NPNF. Sediment is considered to be delivered to the channel system when it reaches a stream with defined bed and banks. Within the sediment model, this is assumed to occur at a catchment area of 1 mi² (USDA Forest Service, 1981).

Instream Processes

Once sediment is delivered to the channel system, it is subject to transport or deposition. Transport can occur as suspended or bedload sediment. Fine materials, such as clay, silt and fine sand are transported in the water column as suspended sediment. This material usually travels through the system rapidly and only deposits in still water. It contributes to the turbidity that is seen during runoff events. During active runoff periods the travel time of suspended sediment through the Red River watershed and out of the South Fork Clearwater River subbasin is less than 24 hours. Monitoring at gaging stations in Red River has indicated that suspended sediment constitutes about 40% to 60% of the annual sediment yield (Gloss, 1995). Recent analyses with a larger dataset suggest that suspended sediment may be a higher proportion of total sediment yield.

Bedload sediment moves along the channel bottom and typically consists of medium and coarse sand, gravel and cobble. Boulders may occasionally move as bedload, but only for short distances in any given event. Bedload transport and deposition is a complex and intermittent process. It is highly dependent on stream energy in terms of streamflow and channel morphology. Under given conditions of streamflow, a river could transport or deposit bedload

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sediment in different reaches or habitat units, depending on gradient and cross-sectional characteristics. Bedload transport is an episodic process that occurs at higher streamflows, with the majority occurring at discharges approaching bankfull and above. Under low and moderate flow conditions, very little if any bedload is in transport.

Materials of various sizes are deposited between episodes of transport. Deposition can involve fines (i.e. sand) intruding into coarse substrates or covering the stream bottom. When large amounts of coarse substrates are deposited, aggradation and changes in bedforms can result. In some cases this can lead to further adjustments, such as bank erosion and changes in channel morphology. Storage of deposited sediment within a given habitat unit or reach may be relatively short, for example between flow events or seasons. In other cases, storage can be on the order of years to indefinitely.

Red Pines Project

There are several erosion processes that could be associated with activities proposed under the Red Pines project, but surface erosion is probably dominant. Activities associated with the project subject to surface erosion include temporary road construction and decommissioning, logging, site prep and fuel reduction activities associated with timber harvest units, decommissioning of existing roads, soil restoration, and culvert replacements. Mitigation measures and BMPs are designed to reduce erosion and sediment delivery. Sediment delivery may also occur through direct introduction at stream crossings. This can occur with temporary roads, culvert replacements or culvert removals. Techniques such as dewatering during installations and removals can substantially decrease delivery (King and Gonsior, 1980). Mass erosion is an unlikely occurrence, given the generally rolling landscape, planned actions and mitigation measures. If mass failure does occur, individual events would likely be relatively small, but delivery is fairly efficient, since mass failures tend to occur on steeper slopes that are often adjacent to streams.

Channel morphology and stream gradient for the Red River watershed are described in the EAWS (USDA Forest Service, 2003a). Lower gradient reaches are particularly susceptible to sediment deposition and relatively long term storage. With regard to sediment deposition and transport, one classification system suggests that channels with <3% gradient can be considered response reaches and channels with >3% gradient can be considered either transport or source reaches (Montgomery and Buffington, 1993).

Similarly, the Rosgen stream classification system suggests that A and B channels are relatively high in sediment transport capacity and C, E and F channels are relatively lower (Rosgen, 1996). For surveyed streams in the watershed as whole, 40% of stream length is in A and B channels and 60% of stream length is in C, E, F or G channels (USDA Forest Service, 2003a). The NEZSED model was used to predict surface erosion activity sediment yield from roads and logging. Additional unquantified sediment yield can be expected to accrue from soil restoration, crossing removals, culvert replacements and sediment trap decommissioning activities. Soil restoration is expected to produce relatively little sediment since most of this activity is away from stream channels and soil conditions are left in a decompacted state after completion. The activities at crossings and sediment trap sites are expected to be localized increases, with substantial onsite mitigation to reduce impacts.

Analysis of Trend in Aquatic Condition

The analysis of expected trend in aquatic conditions is an important component of the aquatic assessment. The Forest Plan addresses trends in below objective watersheds with the upward trend direction. Other components of the regulatory framework, such as the Biological Opinions on the Forest Plan and the South Fork Clearwater River TMDLs, provide direction or guidelines related to the trend in aquatic conditions. To assess the expected trend in aquatic conditions a variety of information and tools are used to arrive at a professional conclusion. These tools

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include the NEZSED and FISHSED, and ECA models that focus on sediment and water yields. Information used includes the landscape setting and channel characteristics, project proposals, existing pre-project trends, other activities within the watershed, and qualitative assessment of the effect pathways between management activities and resulting aquatic conditions.

Monitoring data in Red River were useful in assessing trends in aquatic habitat condition. Trends in the sediment transport-stream discharge relationship were analyzed at two gaging stations in Red River for the period of 1986-2001 (Thomas and King, 2004). This analysis grouped the data into the periods 1986-1990, 1991-1993, 1994-1995 and 1996-2001. The groupings were based on assigning similar numbers of samples to each group. It was found that the period of 1991-1993 had the largest sediment load estimate relative to discharge. This was consistent for suspended and bedload sediment yield at both stations. There was no consistent detectable trend in the sediment transport-stream discharge relationship between the first and last period of the study. Although it appears that sediment yield relative to discharge has generally declined since the 1991-1993 period, this cannot be said for the entire period of study. Trend data exist for three aquatic monitoring stations in the Red River watershed. Analysis was completed on cobble embeddedness from each station using data collected from 1988 – 2002. Refer to Chapter 3.6.6.5 for a thorough discussion on the results of this data. Existing conditions appear to be improving at two of the three sites, but are still well removed from desirable levels (USDA, 2003).

To assist in the assessment of the expected trend in aquatic habitat condition, from the variety of influences both quantitative and qualitative, the activities and their expected contribution to aquatic condition are summarized in the table below. The table is a summary of the expected influence of the alternatives on the aquatic conditions in the Red River watershed as a whole. It does not represent an assessment of cumulative effects, or expected trend within specific subwatersheds. Various activities are considered with respect to the variety of aquatic processes that they potentially affect. The contribution to the overall aquatic condition is estimated in terms of positive influence (denoted by “+”) where the activity is expected to contribute to an improvement in condition, and a negative influence (denoted by “-”) where the activity is expected to contribute to degradation in aquatic condition. The amount of influence a specific activity is expected to have on the overall aquatic condition (either positive or negative) is represented by a ranking of high (H), moderate (M), or low (L). Activities rated “High” are those that are expected to have a significant effect at the watershed scale (considering both scope and magnitude). Those rated as “Moderate” are those activities that are expected to have a significant local effect (i.e. at the subwatershed scale), but not result in a significant effect at the watershed scale. Those activities rated “Low” are expected to have only a negligible effect both at the subwatershed and watershed scale.

All of the processes potentially affected by an activity are listed in the table. No ranking, or areas left blank, represent no expected influence on this process or resulting aquatic conditions from this project. The expected contribution of a specific activity on aquatic condition is considered both in terms of short-term and long-term. Short-term influence is judged to be the immediate results of implementing the activity, generally expected to be around a 5-year timeframe. Long-term influence is judged to be the influence the activity will have on aquatic condition as a result of changes in processes and resource conditions that will over time result in changes in aquatic habitat condition. The timeframe for this influence is greater than 5 years.

The Lower Red River Meadows Restoration Project was implemented in the Red River Wildlife Management Area during the period of 1996 through 2000. The goal of the project was to set the degraded stream ecosystem on a path toward self-sustaining dynamic equilibrium. The project affected 2.6 miles of Red River in the meadows between Dawson Creek and Siegel Creek. Monitoring has included data collection on channel morphology, hydrology, riparian condition, fish habitat, fish populations and wildlife habitat. These general areas were subdivided into 33 specific performance indicators that were quantitatively assessed. As of the 2003 field season, 17 of these parameters were meeting or evolving toward desired performance criteria, 14 were

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not and 2 were inconclusive (Klein, 2005). Initial recovery results are encouraging, but it is anticipated that full ecological recovery will require decades.

Each of the processes and indicators in the trend analysis table functions in different time frames. For example, the effectiveness of culverts replacements and instream structural improvements at improving accessibility or fish habitat is almost immediate. At the other extreme is the effectiveness of riparian plantings at providing shade and bank stability, which can take decades to achieve full potential. Between these two poles are processes such as sediment yield increases or decreases, the effects of which can range from immediate to many years, depending on the specific pathway affected. Similarly, the effects to substrate sediment can be relatively fast in terms of deposition, but can range widely in subsequent entrainment and transport.

Aquatic Trend Indicators for Red River

Action	Process Affected	Characteristic Indicator	Alt A Short term	Alt A Long term	Alt B Short term	Alt B Long term	Alt C Short term	Alt C Long term	Alt D Short term	Alt D Long term	Alt E Short term	Alt E Long term
Vegetation Treatments	Surface erosion	Pulse & Chronic Sediment		-L	-M		-M		-M		-M	
	Mass failure risk	Pulse sediment										
	Infiltration, runoff, peaks	Hydrologic process		-L	-M		-M		-M		-M	
	Solar heating	Riparian shade										
	LWD Recruitment	Potential LWD										
Temporary Road Construction	Surface erosion	Pulse & Chronic Sediment			-H		-H		-H		-H	
	Mass failure risk	Pulse sediment										
	Infiltration, runoff, peaks	Hydrologic process			-M	-L	-M	-L	-M	-L	-M	-L
	Fish passage	Habitat availability										
	Riparian shade	Riparian condition			-L		-L		-L		-L	
	LWD Recruitment	Potential LWD			-L		-L		-L		-L	
Road Recon and Improvement	Surface erosion	Pulse & Chronic Sediment			-M		-M		-M		-M	
	Mass failure risk	Pulse sediment										
	Infiltration, runoff, peaks	Hydrologic process										
	Fish Passage	Habitat availability										
Road Decommissioning	Surface erosion	Pulse & Chronic Sediment			-L	+L	-L	+L	-L	+L	-L	+L
	Mass failure risk	Pulse sediment										
	Infiltration, runoff, peaks	Hydrologic process			+L	+L	+L	+L	+L	+L	-L	+L
	Fish Passage	Habitat availability										
	Riparian Shade	Riparian condition				+L		+L		+L		+L
	LWD Recruitment	Potential LWD										

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Action	Process Affected	Characteristic Indicator	Alt A Short term	Alt A Long term	Alt B Short term	Alt B Long term	Alt C Short term	Alt C Long term	Alt D Short term	Alt D Long term	Alt E Short term	Alt E Long term
Stream Crossing Improvement	Surface erosion	Pulse & Chronic Sediment			-M	+L	-M	+L	-M	+L	-M	+L
	Mass failure risk	Pulse sediment			+L	+M	+L	+M	+L	+M	+L	+M
	Infiltration, runoff, peaks	Hydrologic process										
	Fish Passage	Habitat availability			+M	+M	+M	+M	+M	+M	+M	+M
In-Channel & Riparian Restoration	Construction sediment	Pulse & Chronic Sediment			-L	+L	-L	+L	-L	+L	-L	+L
	Habitat Quality	Channel Dimensions			+L	+L	+L	+L	+L	+L	+L	+L
	Riparian shade	Riparian Condition				+L		+L		+L		+L
	LWD Recruitment	Acting LWD	+L	+L	+L	+M	+L	+M	+L	+M	+L	+M

Soil Restoration	Surface erosion	Pulse & Chronic Sediment			-L	+L	-L	+L	-L	+L	-L	+L
	Mass failure risk	Pulse sediment										
	Infiltration, runoff, peaks	Hydrologic process			+L	+L	+L	+L	+L	+L	+L	+L
	Riparian Shade	Riparian Condition										
Mine Site Reclamation	Surface Erosion	Pulse & Chronic Sediment			+L	+L	+L	+L	+L	+L	+L	+L
	Infiltration, runoff, etc	Hydrologic process			+L	+L	+L	+L	+L	+L	+L	+L
	Riparian Interaction, Shade	Riparian Conditions										
Rec & Trail Improvements	Surface Erosion	Pulse & Chronic Sediment			-L	+L	-L	+L	-L	+L	+L	+L
	Infiltration, Runoff, etc	Hydrologic Processes			+L	+L	+L	+L	+L	+L	+L	+L
	Riparian Interaction, Shade	Riparian Condition										

The above ratings by activity can be summarized by the effect pathways by assigning a value to the Low, Moderate, and High ranking (L=1, M=2, H=3).

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The table below summarizes the alternatives by the effect pathway and for the alternative in general (total).

Action	Process Affected	Characteristic Indicator	Alt A Short term	Alt A Long term	Alt B Short term	Alt B Long term	Alt C Short term	Alt C Long term	Alt D Short term	Alt D Long term	Alt E Short term	Alt E Long term
Summary	Surface erosion	Pulse & Chronic Sediment	0	-1	-12	6	-12	6	-11	6	-12	6
	Mass failure risk	Pulse sediment	0	0	1	2	1	2	1	2	1	2
	Infiltration, runoff, peaks	Hydrologic process	0	-1	0	3	0	3	0	3	0	3
	Riparian Shade	Riparian Condition	0	0	-1	2	-1	2	-1	2	-1	2
	LWD Recruitment	Acting LWD	0	0	0	2	0	2	0	2	0	2
	Fish Passage	Habitat availability	0	0	2	2	2	2	2	2	2	2
	Habitat Quality	Channel Dimensions	0	0	1	1	1	1	1	1	1	1
Total			+1	-1	-9	18	-9	18	-8	18	-8	18

The above table of indicators of aquatic trend is another tool that is used in reaching a conclusion about what the expected trends from this project are expected to be in the Red River watershed. This table illustrates the general relationships between project activities and expected consequences in aquatic conditions.

The expected short-term consequences of the Red Pines project on aquatic condition in the Red River watershed is principally related to the surface erosion process and sediment conditions. All of the activities, except mine site reclamation, riparian planting and large woody debris placement, are expected to be a negative effect on aquatic condition in the short term due to the sediment yield associated with conducting the project activities. The temporary road construction is judged to be the largest contributor to this effect, followed by the harvest activities, road reconstruction and improvement, and stream crossing improvements. Road decommissioning, in-channel restoration, soil restoration, and recreation and trail improvements are expected to also contribute to this effect, but at a minor level. Mine site reclamation is considered an immediate improvement in surface erosion effects based on the location of the mine sites (generally away from streams) and the effectiveness of the restoration treatments in immediately reducing the surface erosion from these sites. The other short-term negative consequences of the project on aquatic conditions were related to effects of the temporary road construction and harvest on the hydrologic processes of runoff and infiltration, and some minor effects of the temporary road construction on riparian conditions and large woody debris recruitment to streams from construction of these roads in the RHCA and particularly at stream crossings.

The expected short-term positive consequences of the Red Pines project on aquatic conditions in the Red River watershed are associated with restoration projects where an immediate improvement in condition results from project implementation. The greatest benefit in this category is associated with the increased habitat availability that immediately results from stream crossing improvements where fish passage is improved. Road decommissioning, stream crossing improvements focused on hydrologic function, in-channel and riparian restoration, soil restoration, mine site restoration, and recreation and trail improvements are all considered to

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result in some minor immediate improvements, principally related to improvements in the hydrologic process. The in-channel restoration is expected to result in immediate improvement in both habitat quality (principally “the narrows” project) and large woody debris levels.

The expected long-term consequences of the Red Pines project on aquatic condition in the Red River watershed are all considered positive, with the exception of some continued minor negative effects on the hydrologic process associated with the temporary roads. All of the aquatic restoration projects are expected to have positive long-term consequences on the aquatic conditions in the watershed. The greatest effect from these activities is associated with the increased habitat availability from fish passage improvements, the reduced risk of future crossing failures associated with the crossing improvements associated with hydrologic function, and the increased instream large woody debris levels.

Using the above trend summary and all of the other project analysis products and information, a professional conclusion regarding the expected trend in aquatic conditions was developed. This analysis was completed for each alternative for each prescription watershed in the project area. The consequences of this analysis were used to develop the proposed Forest Plan amendment related to the requirement for an upward trend (see Red Pines Project File). This analysis of the alternatives is related to the Red River watershed in general.

In many of the tributary subwatersheds in Red River, the Red Pines project is expected to result in an upward trend in aquatic conditions. Alternative E will provide for an upward trend in the greatest number of these areas, with Alternative D having a similar number. Alternative D closely matches Alternative E but does have more miles of temporary road construction and fewer miles of existing road decommissioning. Alternatives B and C have the most subwatersheds that will not meet upward trend. In alternatives B and C the magnitude of the sediment effects generated from the activities, such as temporary road construction, are generally more often the basis of the trend conclusion. Alternative E has the greatest amount and number of restoration activities and is most often the basis of the trend conclusion.

The conclusions regarding aquatic trends in many of the subwatersheds and composite watersheds in Red River are the consequence of subtle balances between the short-term impacts and long-term improvements. A relatively modest shift in those balances could result in a different set of conclusions regarding aquatic trends. The trend conclusions must also be tempered with knowledge of the inherently variable conditions within the watershed and the unpredictability of weather and natural disturbance events. Future trend will likely be very much influenced by future events –both management activities and natural events.

Restoration Activities (watershed and aquatic)

This section of Appendix H includes a detailed list by subwatershed of potential restoration projects that would improve watershed and aquatic conditions in the Red River watershed. Restoration projects are listed by subwatershed, by alternative and then keyed as either “P” for proposed or “D” for discretionary. Proposed projects (P) are those included in an alternative to balance fuels treatments with restoration projects needed to achieve an improvement in aquatic habitat condition (described as an upward trend), by subwatershed. Discretionary projects (D) are projects that would provide an improvement in aquatic habitat condition but are not needed to achieve an upward trend, and are primarily on private lands and.

The Nez Perce National Forest sediment yield model (NEZSED; described in this appendix) was used for both scenarios and results are listed in the Watershed Quality section of the main document (Section 3.5).

Restoration projects were identified using a compilation of new and existing data currently on file. It must be recognized that additional data is needed to refine the details of improvement projects prior to implementation.

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Road Decommissioning projects are recommended on approximately **85 to 104 miles**, depending upon alternative. The amount of discretionary miles ranges from **0 to 19 miles**, depending upon alternative.. These roads have been surveyed and represent an interdisciplinary, integrated recommendation for decommissioning. The selection of treatment type is based on the condition of the road, proximity to resource values such as streams, cost, and other factors. The objectives of road decommissioning are to reduce resource impacts (sediment delivery, ground water interception, under-sized culverts) and reduce maintenance costs by removing roads that are not needed for access. Road decommissioning includes a range of treatment from full re-contouring to abandonment (road to be removed from the road system without disturbance of established vegetation and have adequate drainage at stream crossings and are considered stable).

Soil Restoration projects are proposed on approximately **453 to 556 acres**, depending upon alternative. The amount of discretionary acres ranges from **0 to 108 acres**, depending upon alternative. Objectives of soil restoration include improvement of soil productivity and to reduce adverse effects to aquatic resources, such as decreased infiltration and increased erosion and runoff. Treatments can include road decommissioning, road-recontouring, soil-decompaction, replacing surface soil and organic material, and restoration of erosion features such as rills and gullies. The amount of soil restoration acres are identified by subwatersheds in described in this Appendix.

Road reconditioning of the existing system roads is proposed on approximately **63 to 76 miles**, depending upon alternative. Reconditioning is a combination of road ditch clean-out, blading and shaping the road surface to maintain a proper road template and drainage, or surfacing. This treatment is similar to road maintenance.

Mine rehabilitation projects would stabilize and revegetate **21 inactive sites (18 hard rock, 3 placer)**. Mining activities have affected large areas throughout the Red River watershed. This includes soil disturbance that has increased sediment delivery to streams, raw and exposed soils that have allowed for noxious weed infestation, mine tailings that have altered the landscape and riparian areas, and mining roads that are rutted and transporting sediment to adjacent streams. Inventories were completed in the spring 2005 to determine the extent of disturbance and the appropriate methods needed for restoration. Inactive mine rehabilitation will focus on include weed invasion monitoring and removal, revegetation with native grasses, shrubs, and trees in most locations, and possibly some recontouring of existing skid roads. Detailed information on each site is in the project file.

Stream crossing improvement projects are proposed at **43 sites**. Each crossing has various issued identified and these are listed in detail in Appendix H. Projects are proposed to improve upstream passage of aquatic organisms, particularly spawning salmonids, and/or reduce the risk of culvert failure during runoff events. In some cases, culverts could be upgraded by retrofitting with baffles or other means. In other situations, they could be replaced with larger culverts or other stream crossing devices. Log culverts should be removed completely with the crossing returned to as natural a gradient as possible, or hardening of the crossing for a natural ford where necessary.

Culvert/Log bridge removal projects are proposed on **19 sites** and an additional **2 sites** to be treated as funding becomes available (discretionary). These sites have been identified on roads that will be decommissioned. The purpose of the proposed projects is the same as stream crossing improvements but the structure (culvert or log bridge) will be removed and not replaced. Each crossing will be recontoured and revegetated, as needed.

Riparian restoration is proposed along approximately **20 miles of stream**. This restoration is proposed in those areas where past activities including mining, harvest, grazing, and road construction have occurred. Objectives would include re-establishment of the floodplain

connectivity and function, and recovery of the vegetation communities to improve streamside shade, and improve aquatic ecological function. This could include projects that would provide stabilization of stream banks by placement of boulders and/or root wads, planting of native tree and shrub species for stabilization of stream banks and shade enhancement, and possibly relocation or decommissioning of roads that are negatively affecting stream channels. **Large woody debris placement** is done to improve aquatic habitat and restore natural function of stream systems and is proposed on **28 miles** of stream.

Fencing is proposed **along 5 miles** of the main stem of **Red River**, primarily through the meadow reaches **and along 1 mile** of the lower main stem of **Moose Butte Creek**. Fencing will help reduce impacts to the banks and the channels from on-going domestic grazing activities that are occurring on from private holdings within the Red River watershed. Proposed fencing is proposed on forest service lands that are grazed. Coordination and concurrence with private landowners must occur to implement fencing on the discretionary portions.

In-stream fish structure maintenance projects are proposed along approximately **8.0 miles of stream**. Maintenance is proposed at several locations on the mainstem of Red River, Little Moose Creek, and Moose Butte Creek. These structures were installed in the 1980's to help promote pool formation. Over the past two decades some of these structures have failed and the pools are now filling with sediment. A review of each structure would be performed and then either completely removed or replaced with materials such as boulders or root wads that would function more naturally for a longer period of time.

In-stream restoration projects are recommended on approximately **2.0 miles on stream** on various stream segments. As a result of extensive historic mining activities, selected stream segments have experienced changes in channel morphology and a resultant loss in fish habitat. In-stream restoration may include the placement of boulders and/or root wads within the channel for flow diversion, working to stabilize stream banks and create pools for fish habitat, to actual relocation of altered stream channels to their historic flow location and regime/pattern.

Recreation site improvement projects are proposed on **15 acres** and are associated with the restoration work with the "Narrows" area, Ditch Creek Campground and Red River Campground.

Rock quarry restoration would occur at **one (1) site** on main Red River (5 acres). The quarry is located upstream of the Red River Ranger station approximately ¼ mile. It is no longer being used for materials, and would be recontoured and stabilized to reduce erosion and sediment delivery to streams.

Sediment trap decommissioning is proposed at **two (2) sites**, and at one (1) discretionary site (approximately 6 acres). These traps were installed on both Dawson Creek and Moose Butte Creek around 1988 to trap sediment. Traps are not being maintained or functioning properly and are no longer needed. The sediment traps would be removed and the areas stabilized.

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WATERSHED RESTORATION PROJECTS

Table H-3a: Watershed Improvement Projects Totals (all action alternatives)

Improvement Project Type	Unit Cost	Proposed Quantity	Costs	Discretionary Quantity	Costs
Stream Crossing Improvement – fish passage barrier, culvert upgrade, culvert replacement (each)	\$30,000-50,000	20	600,000-1,000,000	13	390,000-650,000
Culvert/log bridge removal (each)	\$5,000	19	95,000	2	10,000
Placer mine reclamation (acre)	\$2,000	23.0	46,000	0	0
Rock quarry restoration (acre)	\$10,000	5.0	50,000	0	0
Instream sediment trap decommission (acre)	\$1,700	4.0	6,800	2.0	3,400
Large Woody Material instream/riparian placement (mile)	\$1,500	28.0	42,000	0	0
Instream fish structure enhancement (mile)	\$1,000	8.0	8,000	0	0
Native planting – riparian (mile)	\$1,000	20.0	20,000	0	0
Native planting – campgrounds (acre)	\$1,000	15.0	15,000	0	0
Road to trail conversion (mile)	\$3,000	0.67	2,010	0	0
Riparian fencing (mile)	\$10,000	1	10,000	5	50,000
Soil restoration (acre)	\$2,600	25.3	65,780	0	0
Narrows project – instream restoration due to past dredge mining (mile)	\$100,000	2.0	200,000	0	0
Narrows project – hardening of dispersed campsites, riparian plantings, and closure of existing non-system riparian roads, and upgrades, maintain one access road to campsites (mile)	\$10,000	2.0	20,000	0	0
Siegal Creek watershed road improvement (mile)	\$10,000	6.24	62,400	0	0
Siegal Creek culvert/bridge replacement (each)	\$30,000	4	120,000	2	60,000
Total Costs			\$1,362,990 - \$1,762,990		\$513,400 - \$773,400

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Table H-3b: Watershed Restoration Projects

Project Type: P = proposed, D = discretionary

Those fields in italic print indicate potential change from abandon to recontour due to soil restoration needs. Additional field review is necessary to prepare final design and contract package to implement projects.

Dawson Creek – 170603050401

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1800E1	1.10	Moderate	None	Recontour	P	D	D	P
1800F1	0.09	Low	None	Recontour	P	P	P	P
1800G2	0.56	High	2133	Recontour	P	P	P	P
1800H1	0.03	Low	None	<i>Recontour</i>	P	P	P	P
1800W	1.01	High	2222	Recondition/Recontour	P	P	P	P
77172	0.22	Low	None	<i>Recontour</i>	P	P	P	P
77173	0.55	Low	None	<i>Recontour</i>	P	P	P	P
77174	0.41	Low	None	<i>Recontour</i>	P	P	P	P
77175	0.24	Low	2515, 2216	Abandon	P	P	P	P
77176	0.57	Low	None	Abandon	P	P	P	P
77176A	0.24	High	None	Recontour	P	P	P	P
77177	0.30	High	None	Abandon	P	P	P	P
77177A	0.20	High	None	Abandon	P	P	P	P
77178	0.62	High	None	Abandon	P	P	P	P
77180	0.10	High	None	Recontour	P	P	P	P
77181	0.14	High	None	<i>Recontour</i>	P	P	P	P
77182	0.58	High	None	Convert to Trail	P	P	P	P
77183	0.45	High	None	<i>Recontour</i>	P	P	P	P
77183A	0.02	High	None	<i>Recontour</i>	P	P	P	P
77184	0.39	High	None	<i>Recontour</i>	P	P	P	P
Miles per alt	7.82				7.82	D=1.10 P=6.72	D=1.10 P=6.72	7.82

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Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1800	2121	Low	Fish Passage Barrier	D	D	D	D	Dawson Creek
1800	2131	Low	Fish Passage Barrier	D	D	D	D	Dawson Creek
1800G	2100	Low	Fish Passage Barrier	D	D	D	D	Dawson Creek
1800G1	2104	High	Log Bridge Removal	P	P	P	P	Dawson Creek
1800G	2132	Low	Partial Fish Passage Barrier	D	D	D	D	Dawson Creek

Improvement Projects

Project Name	Implementation Priority	Alt B	Alt C	Alt D	Alt E	Stream
Dawson Creek sediment trap – remove – collaboration with private landowners required – 1 acre	Low	D	D	D	D	Dawson Creek

Lower Main Red River – 170603050402

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1151B	0.45	Low	None	Recontour	D	D	D	P
1183C	0.53	High	2176, 2191	Recondition/Recontour	P	P	D	P
1800A1	0.28	High	1969	Recontour	P	P	P	P
1800A2	0.59	High	1761	Recontour	P	P	P	P
1800B	0.62	Low	None	Recontour	P	D	D	P
1800C1	0.59	High	None	Recondition/Recontour	P	P	P	P
1800C2	0.31	High	1980	Recontour	P	P	P	P
1800D1	0.18	Low	None	Recondition/Recontour	P	D	D	P
1800E1	0.06	Moderate	None	Recontour	P	D	D	P
1800K	0.12	Low	None	Recontour	P	D	D	P
1800L	0.21	Low	None	Recontour	P	D	D	P
1806B1	0.43	Low	2053	Recontour	P	P	P	P
1806C	3.90	High	1913, 1941	Recontour from Loon Creek to terminus	D	D	P	P

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1806C1	1.34	High	None	Recondition/Recontour	P	P	P	P
9501	0.33	Low	None	Recontour	P	D	D	P
9506	0.36	High	None	Recontour	P	P	P	P
9514	0.03	High	None	Recondition/Recontour	P	P	P	P
9514A	0.09	High	None	Recontour	P	P	P	P
9517A	0.29	Moderate	None	Recondition/Recontour	P	P	D	P
9517A1	0.35	Low	None	Abandon	P	P	P	P
9519A	0.22	High	None	Recontour	P	P	P	P
9533A	0.16	Low	None	Recontour	P	D	D	P
9533B	0.01	Moderate	None	Recontour	P	P	P	P
77162	0.18	Low	None	Recontour	D	D	D	P
77163	1.01	Moderate	None	Recontour	P	D	D	P
77164	0.37	Low	None	Recontour	P	P	D	P
77165	0.42	Low	None	Recontour	P	P	D	P
77165A	0.24	Low	None	Recontour	P	P	D	P
77167	0.18	Low	None	Recontour	P	P	D	P
77168	0.23	Low	None	Recontour	P	P	D	P
77169	0.23	Low	None	Recontour	P	P	D	P
77170	0.10	Low	None	Recontour	P	P	D	P
77171	0.10	Low	None	Recontour	P	P	D	P
77217	0.62	High	1880	Recontour	P	P	P	P
77218	0.33	High	1882	Recontour	P	P	P	P
77219	0.41	Moderate	None	Recontour	P	P	D	P
77222	0.15	Low	None	Recontour	P	P	D	P
77223	0.23	Low	None	Recontour	P	P	D	P
77224	0.39	Low	None	Recontour	P	P	P	P
77225	0.22	High	2166	Recondition/Recontour	P	P	D	P
77242	0.34	Low	None	Abandon	P	P	P	P
77289	0.77	Moderate	None	Recondition/Recontour	P	P	D	P
77310	0.44	Low	None	Recontour	P	D	D	P
77332	0.44	Low	None	Recontour	P	D	D	P
78496D	0.06	High	None	Recontour	P	P	P	P
Miles per alt	18.76				D=4.53 P=14.23	D=8.15 P=10.61	D=8.71 P=10.05	18.76

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Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1800A3	1876	High	Log Culvert – remove	P	P	P	P	Cole Creek
1800C	1956	High	Log Culvert – remove	P	P	P	P	Sixty-six Creek
1800A	1870	High	Log Culvert – remove	P	P	P	P	Cole Creek
1800C2	1980	High	Log Culvert – remove	P	P	P	P	Sixty-six Creek
1806C	1913	High	Log Culvert – remove	P	P	P	P	Galena Creek
1806C	1941	High	Log Culvert – remove	P	P	P	P	Galena Creek
1800	1986	Low	Fish Passage Barrier	D	D	D	D	Sixty-six Creek
222	2052	Moderate	Fish Passage Barrier, County	D	D	D	D	Cartwright Creek
222	2095	Moderate	Fish Passage Barrier, County	D	D	D	D	Unnamed Tributary to Red River
222	2188	High	Fish Passage Barrier, County	D	D	D	D	Unnamed Tributary to Red River

Improvement projects

Project Name	Implementation Priority	Alt B	Alt C	Alt D	Alt E	Stream
Fencing mainstem Red River from grazing impacts – 8.0 miles – collaboration with private landowners	High	D	D	D	D	Red River
Fencing mainstem Red River from grazing impacts – 2.0 miles	High	P	P	P	P	Red River
Large Woody Debris placement in-channel – 1.0 mile	High	P	P	P	P	Red River
In-stream dredge mining restoration – 2.00 miles – The Narrows project – see AML Project Report 2005	High	P	P	P	P	Red River
Riparian restoration – The Narrow project – hardening of dispersed campsites, riparian plantings, and closure of non-system existing roads in riparian area and upgrade and maintain one access road to campsites.	High	P	P	P	P	Red River

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Riparian restoration – native species plantings – 10.0 stream miles – collaboration with private landowners (It must be noted that recent developments have caused the Soil Conservation District to drop the previously proposed restoration project of Main Red River on the privately owned segments adjacent to the Wildlife Management Area. For the purposes of this document it was decided to leave the proposed restoration work in as it was felt that possible funds may become available and private landowners may agree to collaboration on this work.)	High	D	D	D	D	Red River
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Siegel Creek – 170603050403

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
9818A	0.20	High	None	Recontour	P	P	P	P
77207	0.04	Low	None	Recontour	P	P	P	P
Miles per alt	.24				.24	.24	.24	.24

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1182	1664	High	Fish Passage and Hydraulic	P	P	P	P	Boyer Creek
1182	1662	Moderate	Culvert Upgrade (Private Prop)	D	D	D	D	Siegel Creek
1182A	1598	High	Failed Log Bridge	P	P	P	P	Unnamed Tributary to Siegel Creek
1182C	1634	Moderate	Upgrade Snowmobile Log Bridge	P	P	P	P	Boyer Creek
Private	Private	High	Possible Fish Passage Barrier	D	D	D	D	Little Siegel Creek
1182A	1606	High	Failed Log Bridge	P	P	P	P	Siegel Creek

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Improvement projects

Project Name	Implementation Priority	Alt B	Alt C	Alt D	Alt D	Stream
Watershed road recondition on FS roads 1182, 1182A, and 1182C. 6.24 total miles of recondition	High	P	P	P	P	Siegel Creek
6 hardrock mine sites – restoration includes gates/closures to open adits, plantings of native grasses/shrub/trees to waste dumps/review of water quality - ~4.5 acres	High	P	P	P	P	Siegel
Large Woody Debris placement – 3.0 miles on lower stretch of Siegel Creek	High	P	P	P	P	Siegel Creek

Ditch Creek – 170603050404

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
234D1	0.09	High	None	Convert to Trail	P	P	D	P
1183	1.50	Moderate	None	Recontour from 7.00 mm to terminus				P
1183A	0.40	Moderate	None	Recontour	P	P	P	P
1183E	0.35	High	1842	Recontour	P	P	P	P
1189A	0.71	Moderate	None	Recontour	P	P	P	
9516A	0.24	Low	None	Recontour	P	P	D	P
9518A	0.39	Moderate	None	Recontour	P	P	P	
9518B	0.19	High	None	Recontour	P	P	P	P
77207	0.46	Moderate	None	Recontour	P	P	D	P
77210A	0.42	Low	None	Recontour	P	P	D	P
77212A	0.04	Low	None	Recontour	P	P	D	P
77212B	0.19	Low	None	Recontour	P	D	P	
77212C	0.13	Low	None	Recontour	P	D	P	
77213	1.03	High	None	Recontour	P	P	P	P
77214	0.22	Low	None	Recontour	P	D	P	
77215	0.22	High	None	Recontour	P	P	P	
77216	0.27	Low	None	Recontour	P	D	P	
77290	0.18	Moderate	None	Recontour	P	P	P	
77291	0.30	Low	None	Recontour	P	P	D	P
Miles per alt	7.32				5.82	D=0.82 P=5.0	D=3.47 P=2.35	5.81

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Improvement projects

Project Name	Implementation Priority	Alt B	Alt C	Alt D	Alt E	Stream
5 hardrock mine sites – restoration includes gates/closures to open adits, plantings of native grasses/shrub/trees to waste dumps/review of water quality - ~3.6 acres	Moderate	P	P	P	P	Ditch Creek
Ditch Creek Campground restoration – planting native species – 5.0 acres	Moderate	P	P	P	P	Ditch Creek

Trail Creek – 170603050405

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
423D	0.84	Moderate	None	Recontour	P	P	D	P
423E	0.53	High	None	Recondition/Recontour	P	P	P	P
77209	0.30	Moderate	None	Recontour	P	P	D	P
77221	0.85	Moderate	None	Recontour	P	P	D	P
77221A	0.13	Moderate	None	Recontour	P	P	D	P
77320	0.20	Moderate	None	Recontour	P	P	D	P
Miles per Alt	2.85				2.85	2.85	D=2.32 P=0.53	2.85

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
423C	1585	Moderate	Log culvert – remove	D	D	D	D	Trail Creek
423C	1594	Moderate	Log culvert - remove	D	D	D	D	Trail Creek

Baston Creek – 170603050409

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
77265	0.13	High	None	Recontour	P	P	P	P
Miles per Alt	0.13				0.13	0.13	0.13	0.13

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Soda Creek – 170603050410

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1172E	0.51	High	None	Recontour	P	P	P	P
1172F	1.38	High	2030, 2049, 2058, 2075, 2103, 2123	Recondition/Recontour	P	P	P	P
77230	0.19	Moderate	None	Recontour	P	P	P	P
77231	0.47	Moderate	None	Recontour	P	P	P	P
77335	0.10	Moderate	None	Recontour	P	P	P	P
77336	0.18	Moderate	None	Recontour	P	D	D	P
9507	0.44	Moderate	None	Recontour		P	P	P
9507A	0.50	High	2101	Recontour	P	P	P	
9541A	0.49	Moderate	None	Recontour	P	P	P	P
9541B	0.61	Moderate	None	Recontour	P	P	P	P
9541D	0.35	Moderate	None	Recontour	P	P	P	P
Miles per Alt	5.22				4.41	D=0.18 P=5.04	D=0.18 P=5.04	4.72

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1172	1930	High	Fish Passage Barrier	P	P	P	P	Soda Creek
1172	2033	High	Fish Passage Barrier	P	P	P	P	Soda Creek
1172	2076	High	Fish Passage Barrier	P	P	P	P	Soda Creek
1172	2110	High	Fish Passage Barrier	P	P	P	P	Soda Creek
1172	2172	High	Fish Passage Barrier	P	P	P	P	Soda Creek
1172	2175	High	Fish Passage Barrier	P	P	P	P	Soda Creek
9542	2209	Moderate	Fish Passage Barrier	P	P	P	P	Soda Creek
9542	2180	Moderate	Fish Passage Barrier	P	P	P	P	Soda Creek
9524	2171	Moderate	Fish Passage Barrier	P	P	P	P	Soda Creek
9542	2115	Moderate	Fish Passage Barrier	P	P	P	P	Soda Creek
1172F	2030	High	Log culvert - remove	P	P	P	P	Soda Creek
1172F	2075	High	Log culvert - remove	P	P	P	P	Soda Creek
9507A	2091	High	Log culvert - remove	P	P	P	P	Soda Creek
9507	2101	Moderate	Log culvert - remove	P	P	P	P	Soda Creek
9507	2123	Moderate	Log culvert - remove	P	P	P	P	Soda Creek

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Main Red River – 170603050411

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1172A	0.85	Moderate	2312	Recondition/Recontour	P	P	P	P
1172B	0.55	Low	None	Recontour	P	P	P	P
1172D	0.90	Low	None	Recontour	P	P	P	P
1172F	1.13	High	2041	Recontour	P	P	P	P
1184	1.59	High	2014	Recontour	P	P	P	P
1184A	0.51	High	None	Recontour	P	P	P	P
9515A	0.57	High	None	Abandon	P	P	P	P
9516A	0.13	Low	None	Recontour	P	P	D	P
9519A	0.45	High	2263	Recontour	P	P	P	P
9541C	0.36	Moderate	None	Recontour	P	P	D	P
77215	0.03	High	None	Recontour	P	P	D	
77227	0.53	Low	None	Recontour	P	P	D	P
77228	0.13	Low	None	Recondition/Recontour	P	P	P	P
77234	0.16	High	None	Abandon	P	P	P	P
77235	0.38	High	None	Abandon	P	P	P	P
77235A	0.15	High	None	Abandon	P	P	P	P
77236	0.11	Low	None	Recontour	P	D	D	P
77237	0.89	High	2247, 2251	Abandon	P	P	P	P
77238	0.70	Moderate	None	Recontour	P	D	D	P
77238A	0.45	High	None	Abandon	P	P	P	P
77238A1	0.30	High	None	Abandon	P	P	P	P
77239	0.60	Low	None	Recontour	P	D	D	P
77239A	0.19	High	None	Abandon	P	P	P	P
77241	0.32	High	None	Recondition/Recontour	P	P	P	P
77264	0.41	High	None	Recontour	P	P	P	P
77264A	0.17	High	None	Recontour	P	P	P	P
77264B	0.25	High	None	Recontour	P	P	P	P
77265	0.06	High	None	Abandon	P	P	P	P
77269	0.14	Low	None	Recontour	P	D	D	P
77289	0.03	Moderate	None	Recondition/Recontour	P	P	D	P
77290	0.02	Low	None	Recontour	P	P	D	

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77333A	0.39	Moderate	None	Recontour	P	P	P	P
77334	0.47	High	None	Recontour	P	P	P	P
77335	0.13	Moderate	None	Recontour	P	P	P	P
Miles per Alt	14.02				14.02	D=1.13 P=12.89	D=2.64 P=11.38	13.98

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1132	2073	High	Log culvert-remove	P	P	P	P	Baston Creek
234	2158	High	Fish passage-barrier	D	D	D	D	Unnamed Tributary to Red River

Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
Large Woody Debris placement – 10.0 miles – in-channel	High	P	P	P	P	Red River
In-stream enhancement structures – 6.0 miles - evaluate and maintain/upgrade as needed	High	P	P	P	P	Red River
2 hardrock mine sites – restoration includes gates/closures to open adits, plantings of native grasses/shrub/trees to waste dumps/review of water quality - ~2.0 acres	High	P	P	P	P	Steckner Creek
Riparian restoration –6.0 miles – plant native species	High	P	P	P	P	Red River
Red River Campground riparian restoration – 10.0 acres – plant native species	High	P	P	P	P	Red River
Rock pit restoration – 5.0 acres – on 234 road	High	P	P	P	P	Red River

Schooner Creek – 170603050412

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
468N	0.08	Low	None	Recontour	P	P	P	P
468V	0.12	Low	None	Recontour	P	P	P	P
468X	0.43	Low	None	Recontour	P	P	P	P
468Y	0.27	Low	None	Recontour	P	P	P	P
77241	0.31	Low	None	Recondition/Recontour	P	P	P	P
77277	0.16	Low	None	Recontour	P	P	P	P
Miles per Alt	1.37				1.37	1.37	1.37	1.37

Appendix H – Supporting Information Watershed/Aquatics Analysis

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Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
222	2347	High	Fish passage barrier	D	D	D	D	Schooner Creek

Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
Large Woody Debris placement – 1.0 mile – in-channel	High	P	P	P	P	Schooner Creek
Riparian restoration 1.08 mile – plant native species	High	P	P	P	P	Red River
Sediment trap removal – 1 site – 2 acres	High	P	P	P	P	Schooner Creek

Trapper Creek – 170603050413

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1190M	0.17	High	None	Recontour	P	P	P	P
1190N	0.08	High	None	Recontour	P	P	P	P
468D	0.35	High	None	Recontour	P	P	P	P
9550B	0.59	High	None	Recontour	P	P	P	P
9551	0.81	High	2479	Recontour	P	P	P	P
Miles per Alt	2.01				2.01	2.01	2.01	2.01

Pat Brennan Creek – 170603050414

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1190M	0.15	High	None	Recontour	P	P	P	P
1190N	0.27	High	None	Recontour	P	P	P	P
77247	0.25	High	None	Recontour	P	P	P	P
77248	0.07	High	None	Recontour	P	P	P	P
9509	1.35	High	None	Recontour	P	P	P	P
9551	0.82	High	None	Recontour	P	P	P	P
Miles per Alt	2.11				2.11	2.11	2.11	2.11

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Lower South Fork Red River – 170603050415

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1194B1	0.39	High	None	Recontour	P	P	P	P
1196D	0.94	High	None	Recontour	P	P	P	P
77201	0.69	High	None	Recontour	P	P	P	P
77204	0.10	High	None	Recontour	P	P	P	P
77205	0.04	High	None	Recontour	P	P	P	P
77206	0.26	High	None	Recontour	P	P	P	P
77241	0.68	High	None	Recondition/Recontour	P	P	P	P
77244	0.32	High	None	Recontour	P	P	P	P
77247	0.05	High	None	Recontour	P	P	P	P
77248	0.09	High	None	Recontour	P	P	P	P
Miles per Alt	3.55				3.55	3.55	3.55	3.55

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1195	2459	High	Fish passage barrier	P	P	P	P	Deer Creek
222	2458	Low	Fish passage barrier	D	D	D	D	Deer Creek

Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
Large Woody Debris placement – 2.0 miles – in-channel	High	P	P	P	P	S Fork Red River
Riparian restoration –1.0 mile – plant native species	High	P	P	P	P	S Fork Red River

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Upper South Fork Red River – 170603050416

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1194A1	0.41	High	None	Recontour	P	P	P	P
77202	0.27	High	None	Recontour	P	P	P	P
77203	0.11	High	None	Recontour	P	P	P	P
9502B	0.17	High	None	Recontour	P	P	P	P
9525	0.80	High	None	Recontour	P	P	P	P
9526	2.40	High	None	Recontour	P	P	P	P
9526B	0.53	High	None	Recontour	P	P	P	P
Miles per Alt	4.69				4.69	4.69	4.69	4.69

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
222	2711	High	Fish passage barrier	D	D	D	D	South Fork Red River

Middle Fork Red River – 170603050417

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
77202	0.17	High	None	Recontour	P	P	P	P
9526B	0.36	High	None	Recontour	P	P	P	P
Miles per Alt	0.53				0.53	0.53	0.53	0.53

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Moose Butte Creek – 170603050419

Decommissioned Roads

Road Number	Miles	Implementation Priority	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1151B	0.10	High	None	Recontour	P	P	P	P
1196D	0.14	High	None	Recontour	P	P	P	P
77244	0.03	High	None	Recontour	P	P	P	P
Miles per Alt	0.26				0.26	0.26	0.26	0.26

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1151	2358	High	Fish passage- barrier	P	P	P	P	Moose Butte Creek
1150B	2363	High	Log culvert-remove	P	P	P	P	Ryan Creek
1196	2376	High	Fish passage-barrier	P	P	P	P	Moose Butte Creek
1196	2392	High	Log culvert-remove	P	P	P	P	Ryan Creek

Improvement projects

Project Name	Mitigation Type	Alt B	Alt C	Alt D	Alt E	Stream
Fencing of stream from grazing impacts – collaboration with private landowners – 1.0mile	High	D	D	D	D	Moose Butte Creek
Large Woody Debris placement – 2.0 miles – in-channel	High	P	P	P	P	Moose Butte Creek
Riparian restoration –2.0 miles – plant native species	High	D	D	D	D	Moose Butte Creek
Sediment trap removal – 2 sites – 4 acres	High	P	P	P	P	Moose Butte Creek
In-stream enhancement structure evaluation – 2.0 mile-evaluate for maintenance/upgrade	High	P	P	P	P	Moose Butte Creek

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Little Moose Creek 170603050420

Decommissioned Roads

Road Number	Miles	Mitigation Type	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
1800H1	0.2	High	None	<i>Recontour</i>	P	P	P	P
9500B	0.32	High	2168	Recontour	P	P	P	P
9500C1	0.32	High	2256, 2257, 2260, 2267, 2282, 2308, 2309	Recontour	P	P	P	P
9506	2.16	High	None	Recontour	P	P	P	P
9511	2.11	High	2276	Recontour	P	P	P	P
9532B1	0.66	High	None	Recontour	P	P	P	P
9532B2	0.55	High	None	Recontour	P	P	P	P
9533B	0.64	High	None	Recontour	P	P	P	P
77183	0.18	High	None	Recontour	P	P	P	P
77183A	0.46	High	None	<i>Recontour</i>	P	P	P	P
77184	0.04	High	None	Recontour	P	P	P	P
77185	0.12	High	None	Recontour	P	P	P	P
77186	0.38	High	None	Recontour	P	P	P	P
77186A	0.09	High	None	Recontour	P	P	P	P
77187	0.59	High	None	Recontour	P	P	P	P
77188	0.15	High	None	Recontour	P	P	P	P
77189	0.14	High	None	Recontour	P	P	P	P
77190	0.56	High	None	Recontour	P	P	P	P
77191	0.50	High	None	Recontour	P	P	P	P
77191A	0.2	High	None	Recontour	P	P	P	P
77192	1.10	High	None	Recontour	P	P	P	P
77287	0.10	High	None	Recontour	P	P	P	P
Miles per Alt	11.61				11.61	11.61	11.61	11.61

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Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
9500	2219	High	Fish passage- barrier	P	P	P	P	Little Moose Butte Creek
9506	2308	High	Log bridge-remove	P	P	P	P	Little Moose Butte Creek
1800	2261	High	Log culvert	P	P	P	P	Little Moose Butte Creek
1800I	2279	High	Fish passage-barrier	P	P	P	P	Little Moose Butte Creek

Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
Large Woody Debris placement – 2.0 miles – in-channel	High	P	P	P	P	Little Moose Butte Creek
Riparian restoration – 2.0 miles – plant native species	High	P	P	P	P	Little Moose Butte Creek
Sediment trap removal – 2 sites – 4 acres	High	P	P	P	P	Little Moose Butte Creek

Blanco Creek – 170603050421

Decommissioned Roads

Road Number	Miles	Mitigation Type	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
77226	0.35	Low	2079	Recontour	D	D	D	P
77310	0.26	High	None	Recontour	P	D	D	P
9504	0.60	High	None	Recontour	P	P	P	P
9514	1.18	High	2161	Recondition/Recontour	P	P	P	P
9514A	0.19	High	None	Recontour	P	P	P	P
9519	1.33	High	None	Recondition/Recontour	P	P	P	P
9519B	0.48	High	None	Recontour	P	P	P	P
Miles per Alt	4.39				D=0.35 P=4.04	D=0.61 P=3.79	D=0.61 P=3.79	4.39

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
234	2258	High	Fish passage- barrier	D	D	D	D	Blanco Creek

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Deadwood Creek - 170603050422

Decommissioned Roads

Road Number	Miles	Mitigation Type	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
522K	0.47	High	None	Recontour	P	P	P	P
522K1	0.47	High	None	Recontour	P	P	P	P
1803C	0.29	High	1810	Recontour	P	P	P	P
1803D	0.87	High	None	Recontour	P	P	P	P
78363	0.35	High	None	<i>Recontour</i>	P	P	P	P
78402	0.38	High	None	Recontour	P	P	P	P
78408	0.56	High	None	Recontour	P	P	P	P
78408A	0.11	High	None	Recontour	P	P	P	P
78408B	0.16	High	None	Recontour	P	P	P	P
78409	0.32	High	None	Abandon	P	P	P	P
78410	0.22	High	None	Recontour	P	P	P	P
78411	0.28	High	None	Abandon	P	P	P	P
78412	0.85	High	None	Recontour	P	P	P	P
78412A	0.39	High	None	Recontour	P	P	P	P
78412A1	0.18	High	None	Recontour	P	P	P	P
78412A2	0.13	High	None	Recontour	P	P	P	P
78501	0.16	High	None	Recontour	P	P	P	P
78502	0.34	High	None	<i>Recontour</i>	P	P	P	P
78504	0.09	High	None	Abandon	P	P	P	P
78505	0.31	High	1806	Recontour	P	P	P	P
78505A	0.1	High	None	Recontour	P	P	P	P
78507	0.43	High	1852	Recontour	P	P	P	P
78508	0.25	High	None	Recontour	P	P	P	P
78508A	0.21	High	None	Recontour	P	P	P	P
78509	0.63	High	None	Recontour	P	P	P	P
78509A	0.29	High	None	Recontour	P	P	P	P
78509B	0.13	High	None	Recontour	P	P	P	P
9803B2	0.13	High	None	Recontour	P	P	P	P
Miles per Alt	9.95				9.95	9.95	9.95	9.95

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Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
522	1869	High	Artificial debris upstream of culvert removal	P	P	P	P	Unnamed Tributary to Deadwood Creek
522	1921	High	Fish passage-barrier	P	P	P	P	Unnamed Tributary to Deadwood Creek
1803	1706	High	Fish passage- barrier	P	P	P	P	Deadwood Creek

Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
Watershed road condition on F S Road 522B – 2.20 miles	High	P	P	P	P	Deadwood Creek
Large Woody Debris placement – 1.0 miles – in-channel	High	P	P	P	P	Deadwood Creek
Riparian restoration –1.0 miles – plant native species	High	P	P	P	P	Deadwood Creek
5 hardrock mine sites – restoration includes gates/closures to open adits, plantings of native grasses/shrub/trees to waste dumps/review of water quality - ~8.0 acres	High	P	P	P	P	Deadwood Creek

Red Horse Creek – 170603050423

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
1807B	1544	High	Failed log bridge	P	P	P	P	Red Horse Creek

Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
1807B Road to trail conversion – 0.43 miles	High	P	P	P	P	Red Horse Creek

French Gulch Creek – 170603050424

Decommissioned Roads

Road Number	Miles	Mitigation Type	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
78560	1.21	High	None	Recontour	P	P	P	P
Miles per Alt	1.21				1.21	1.21	1.21	1.21

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Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
Riparian restoration –1.0 mile – plant native species	High	P	P	P	P	French Gulch Creek

Campbell Creek - 170603050425

Decommissioned Roads

Road Number	Miles	Mitigation Type	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
522	1.09	High	1618	Recontour	P	P	P	P
Miles per Alt	1.09				1.09	1.09	1.09	1.09

Stream Crossing Improvements

Road Number	Crossing Number	Implementation Priority	Issue	Alt B	Alt C	Alt D	Alt E	Stream
522	1593	High	Culvert removal – BLM	P	P	P	P	Little Campbell
1803	1591	High	Culvert replacement-BLM	D	D	D	D	Little Campbell
1803	1652	High	Fish passage-barrier	P	P	P	P	Big Campbell

Lowest Red River - 170603050426

Decommissioned Roads

Road Number	Miles	Mitigation Type	Stream Crossings	Decommission Level	Alt B	Alt C	Alt D	Alt E
78496	1.72	High	1833	Recontour	P	P	P	P
78496A	0.02	High	None	Recontour	P	P	P	P
78496B	0.05	High	None	Recontour	P	P	P	P
78496C	0.09	High	None	Recontour	P	P	P	P
78496D	0.23	High	None	Recontour	P	P	P	P
78497A	0.17	High	None	Recontour	P	P	P	P
78622	0.61	High	None	Recontour	P	P	P	P
9803B1	1.75	High	None	Recontour	P	P	P	P
9803B2	0.76	High	None	Recontour	P	P	P	P
9803B3	0.92	High	None	Recontour	P	P	P	P
9819A2	0.34	High	None	Recontour	P	P	P	P
Miles per Alt	6.65				6.65	6.65	6.65	6.65

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Improvement projects

Project Name	Type	Alt B	Alt C	Alt D	Alt E	Stream
Large Woody Debris placement – 7.0 miles – in-channel	High	P	P	P	P	Lower Red River
3 hardrock mine sites – restoration includes gates/closures to open adits, plantings of native grasses/shrub/trees to waste dumps/review of water quality - ~3.0 acres	High	P	P	P	P	Lower Red River
Riparian restoration –7.0 miles – plant native species	High	P	P	P	P	Lower Red River

Aquatic Landtype Associations (ALTAs)

ALTAs display historic aquatic settings that consider both terrestrial disturbance regimes (fire, erosion) and aquatic disturbance regimes (runoff character, flood timing and how channels process peak flows and sediment inputs). They may have considerable overlap with VRUs and LTAs. ALTAs consider landform, geology, and vegetation and weigh elevation fairly heavily because of the role of ground water temperature and base flows in limiting aquatic habitats, and the relative significance of rain on snow at lower elevations, and sustained runoff at higher elevations. ALTAs are built looking at not only the component landforms, but also the included channel systems, in particular, their size and gradient.

ALTA 1	Broad convex ridges, high elevation, granitic
Subwatersheds: Soda Creek, Main Red River, Trapper Creek, Lower SF Red River, Upper SF Red River, Little Moose	
These are above about 5500 feet elevation, dominantly low relief, with moderate and low gradient channels, mostly low order. These areas historically provided important spawning and rearing habitat for resident and some anadromous species. Snow pack is high, snowmelt is sustained, and groundwater is cold. Base flows are sustained. Fire disturbance is long interval, large size (few thousand to 50,000 acres), often lethal. These areas were important refugia between disturbances at lower elevations.	

ALTA 3	Breaklands, low elevation, granitic
Subwatersheds: Main Red River, Schooner Creek, Trapper Creek, Lower SF Red River, Deadwood Creek, Red Horse Creek, Lowest Main Red River	
These are below about 5000 feet, high relief and steep slopes, with high and moderate gradient channels except for large order streams. Channels are usually highly confined in v-shaped valleys. Larger order streams historically provided important spawning and overwintering habitat. Snowpack is low, rain on snow events can occur, and snowmelt is often rapid. Peak flows may be flashy. Fire disturbance is short and moderate interval, moderate size (several hundred to several thousand acres), and low severity or mixed. Mass wasting and debris torrents are major agents of channel change.	

ALTA 4	Low relief hills, low elevation, granitic
Subwatersheds: Lower Main Red River, Main Red River, Blanco Creek	
These are below about 5500 feet elevation, dominantly low relief, with moderate and low gradient channels. Larger order channels (3rd-4th) tend to be low gradient in moderately to poorly-moderately confined valleys. These historically provided spawning and rearing habitat for resident and some anadromous species. Snowpack is moderate, rain on snow events can occur, but lower gradient channels moderate peak flows. Fire disturbance is short and moderate interval, moderate size (several hundred to 10,000 acres), and low severity or mixed. Cold groundwater upwelling is infrequent.	

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ALTA 6	Low relief hill, mid elevation, granitic
Subwatersheds: Dawson Creek, Lower Main Red River, Siegel Creek, Ditch Creek, Trail Creek, Soda Creek, Main Red River, Schooner Creek, Lower SF Red River, Upper SF Red River, Little Moose Creek, Blanco Creek, Deadwood Creek, Red Horse Creek, French Gulch, Campbell Creek, Lowest Main Red River	
These are at mid elevations in montane basins, 4000-6000 feet, dominantly low relief; with moderate and low channel gradients. Larger order channels (3 rd -4 th) tend to be low gradient, with gravel and cobble substrates and low confinement. These historically provided important spawning and rearing habitat for resident and anadromous species. Snowpack is moderate, but rain on snow events are unlikely. Runoff and base flows are sustained. Groundwater is usually cold, and groundwater upwelling in alluvial valleys may occur. Fire disturbance is moderate to long interval, often lethal, and moderate in size (several hundred to several thousand acres).	

ALTA 18	Alluvial valleys, mid and upper elevation
Subwatersheds: Lower Main Red River, Siegel Creek, Trail Creek, Soda Creek, Schooner Creek, Trapper Creek, Lower SF Red River, Upper SF Red River, Blanco Creek, Deadwood Creek, Red Horse Creek	
These are above about 3000 feet, with low gradient channels, poorly confined in trough-shaped valley bottoms or flat valleys in canyons. Low gradient channels are usually not resistant or resilient. These areas historically provided important spawning and rearing habitat. Snowpack is moderate to high, rain on snow events seldom occur, and runoff is sustained from adjacent uplands. Groundwater upwelling may be common. Fire disturbance is moderate to low frequency, low to mixed severity, and these valleys usually only burn as part of extreme fire conditions in the uplands.	

ALTA 21	Mountain uplands, granitic
Subwatersheds: Red Horse Creek	
These are above approximately 5000 feet, with moderate and high gradient channels, usually well confined in v-shaped or trough-shaped valley bottoms. Channels are usually resistant and resilient. These are cold-water source areas, but low order channels often are too steep or too small for high fish habitat potential. Third order channels or higher may have good habitat potential for cold water dependent resident species. Snowpack is moderate to high, rain on snow events seldom occur, and runoff is usually sustained. Fire disturbance is moderate to low frequency, small to moderate in size and mixed severity.	

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Table H- 4: Transportation System Information - Comparison of Proposed Project and Discretionary Watershed Improvement Activities¹

Sub-watersheds	Alts.	Total Road Miles		Total Road Density ¹ (mi/mi ²)		Streamside Road Density ² (mi/mi ²)		Miles of Decomm. Road ³		Number Stream Xing Improve.		Miles of Recond. Road ⁴	Miles of Temp. Road ⁵
		P ⁶	D ⁷	P	D	P	D	P	D	P	D	P	P
Dawson Creek	A	18.7	18.7	5.7		5.4		0		0		0	0
	B	10.9		3.3		2.9		7.8		1	4	1.4	0.2
	C	12.0	10.9	3.6	3.3	2.9		6.7	1.1	1	4	1.4	0.2
	D	12.0	10.9	3.6	3.3	3.3	2.9	6.7	1.1	1	4	1.4	0.2
	E	10.9		3.3		2.9		7.8				1.3	0.1
Lower Main Red River	A	67.8		4.9		4.4		0		0		0	0
	B	53.6	49.1	3.8	3.5	4.0	3.8	14.2	4.5	6	4	22.3	5.2
	C	57.2	49.1	4.1	3.5	4.0	3.8	10.6	8.2	6	4	22.3	5.2
	D	57.8	49.1	4.1	3.5	3.9	3.8	10.1	8.7	6	4	15.3	4.6
	E	49.1		3.5		3.8		18.8				15.3	4.6
Siegel Creek	A	38.9		3.2		2.7		0		0		0	0
	B	38.7		3.2		2.7		0.2		5	1	9.3	3.4
	C	38.7		3.2		2.7		0.2		5	1	9.3	3.4
	D	38.7		3.2		2.7		0.2		5	1	9.3	0.7
	E	38.7		3.2		2.7		0.2				9.3	0.7
Ditch Creek	A	19.8		4.2		3.9		0		0		0	0
	B	14.0		3.0		2.7		5.8		0		3.2	3.5
	C	14.8	14.0	3.2	3.0	2.8	2.7	5.0	0.8	0		3.2	3.5
	D	17.4	14.0	3.7	3.0	3.1	2.7	2.4	3.5	0		0	1.0
	E	14.0		3.0		2.3		5.8		0		0	0.9
Trail Creek	A	15.5		2.2		2.3		0		0		0	0
	B	12.6		1.8		2.1		2.9		0	2	5.0	0.5
	C	12.6		1.8		2.2	2.1	2.9		0	2	5.0	0.5
	D	14.9	12.6	2.1	1.8	2.2	2.1	0.5	2.3	0	2	5.0	0.5
	E	12.6		1.8		2.1		2.9				5.0	0
Soda Creek	A	18.4		3.5		3.0		0		0		0	0
	B	14.0		2.7		2.4		4.4		13		2.2	1.0
	C	14.2	14.0	2.7	2.7	2.4	2.4	5.0	0.2	13		2.2	1.0
	D	14.2	14.0	2.7	2.7	2.4	2.4	5.0	0.2	13		1.2	0.4
	E	13.7		2.6		2.2		4.7				0.9	0
Main Red River	A	49.2		3.0		3.2		0		0		0	0
	B	35.1		2.1		2.6		14.0		2		10.6	17.7
	C	36.3	35.1	2.2	2.1	2.6	2.6	12.9	1.1	2		10.6	17.5
	D	37.8	35.1	2.3	2.1	2.7	2.6	11.4	2.6	2		9.4	14.3
	E	35.2		2.1		2.6		14.0				9.4	7.7
Schooner Creek	A	9.9		3.9		2.6		0		0		0	0
	B, C, D, E	8.5		3.4		2.3		1.4		1		5.0	0.9

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Sub-watersheds	Alts.	Total Road Miles		Total Road Density ¹ (mi/mi ²)		Streamside Road Density ² (mi/mi ²)		Miles of Decomm. Road ³		Number Stream Xing Improve.		Miles of Recond. Road ⁴	Miles of Temp. Road ⁵
		P ⁶	D ⁷	P	D	P	D	P	D	P	D	P	P
Trapper Creek	A	23.9		2.6		1.9		0		0		0	0
	B, C, D, E	22.0		2.4		1.8		2.0		0		5.5	0.7
Pat Brennan	A	8.6		4.4		2.3		0		0		0	0
	B, C, D, E	6.5		3.3		1.2		2.1		0		0.7	0
Lower SF Red River	A	31.8		4.2		6.2		0		0		0	0
	B, C, D, E	28.2		3.7		6.2		3.6		1	1	6.3	1.0
Upper SF Red River	A	24.0		3.3		3.2		0		0		0	0
	B, C, D, E	19.3		2.6		3.0		4.7		0	1	0.6	0
Little Moose Creek	A	28.2		5.1		5.5		0		0		0	0
	B, C, D, E	16.6		3.0		2.8		11.6		3		1.5	0.6
Moose Butte Creek	A	63.0		5.7		7.6		0				0	0
	B, C, D, E	62.8		5.7		7.6		0.3				0	0
Blanco Creek	A	11.9		5.3		3.1		0		0		0	0
	B	8.5	8.1	3.8	3.6	1.7		4.	0.4	0	1	4.8	0.2
	C, D	8.7	8.1	3.9	3.6	1.7		3.8	0.6	0	1	4.8	0.2
	E	8.1		3.6		1.7		34.4				4.8	0.2
Deadwood Creek	A	40.9		6.6		5.4		0		0		0	0
	B, C, D	32.2		5.2		4.8		10.		3	0	4.7	0
	E	31		5.0		4.4		10.		3	0	4.7	0
Red Horse Creek	A	18.7		2.1		2.1		0		0		0	0
	B, C	18.7		2.1		2.1		0		1	0	4.6	0.9
	D, E	18.7		2.1		2.1		0		1	0	3.8	0.2
French Gulch	A	3.2		2.8		2.1		0		0		0	0
	B, C	3.2		2.8		2.1		1.2		0		0.5	0.5
	D, E	3.2		2.8		2.1		1.2		0		0.5	0
Campbell Creek	A	6.6		3.7		2.9		0		0		0	0
	B, C, D, E	5.5		3.1		1.9		1.1		3		0.6	0
Lowest Main Red River	A	40.8		5.8		7.1		0		0		0	0
	B, C, D	34.2		4.8		6.6		6.7		0		1.6	0.1
	E	34.2		4.8		6.6		6.7		0		1.6	0

1 - Road densities were calculated using GIS runs 10/01/04. Matrix of Pathways and Indicators of Watershed Condition (NOAA 1998) Road density ratings: High = < 1 mi/mi², Moderate = 1-3 mi/mi², Low = > 3 mi/mi²

2 - Matrix of Pathways and Indicators of Watershed Condition (NOAA 1998) Streamside (300 feet on either side of stream channel) road density ratings: High = < 1 mi/mi², Moderate = 1-2 mi/mi², Low = > 2 mi/mi². Calculated for 300 feet RHCAs on perennial streams and 100 feet RHCAs on intermittent streams.

3 - Element of the watershed improvement projects.

4 - Reconditioned roads are needed for haul routes.

5 - New temporary roads would be built to access units and decommissioned after harvest.

6 - Incorporates only proposed project watershed improvement activities

7 - Incorporates proposed project and maximum discretionary watershed improvement activities.

Appendix H – Supporting Information Watershed/Aquatics Analysis